

STRUCTURE OF THIS MICROCARD

1. Read from left to right.
2. Title of microcard (appears on each Coordinate).

E16 | Product/Component/Test Step |

Coordinate

3. Limits of section

Start

Mid-section

End

one-page section

4. Vehicle-related special features are identified on the coordinates A01...A22 by symbols as shown on the right (e.g. new tools, installation positions etc).

5. Reference to relevant test steps in the test specifications (e.g. Coordinate C06). | C06 |

6. THE TROUBLE-SHOOTING CHART IS ON COORDINATE | B01 |

A01 | STRUCTURE OF THIS MICROCARD |

New Microcard.
Opel Kadett / Ascona
European versions (9.82 ->)
with air-flow sensor 0 280 202 033.

SPECIAL FEATURES:

- * L-Jetronic (version LE 2) with 25-pin control unit, 5-pin air-flow sensor, 7-pin control relay, solenoid-operated injection valves with brass wire coil.
- * Cold-start control, i.e. extra fuel injected through all injection valves.
- * No start valve or thermo-time switch.
- * Vehicles for Sweden and Switzerland are equipped with exhaust-gas recirculation and with air-flow sensor 0 280 202 054.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the experienced L-Jetronic expert to quickly check the electrical part of the system with the universal test adapter. The rapid diagnosis chart contains the following information:

- * Sequence of test steps.
- * Settings of V and Ω program switches.
- * Notes on how to operate the universal test adapter or other components.
- * Test specifications for motortester and multimeter.
- * Reference to Coordinates of the relevant detailed testing and trouble-shooting program.

If detailed instructions and information are required, always proceed according to the trouble-shooting charts starting on Coordinates B01/B02.

A02 | SPECIAL FEATURES (1) | ==> |

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

Test step	Switch settings V Ω	Measurement	Control-unit-plug between term.	Remarks	Test specifications (reading)	For trouble-shooting see Coordinates
1	5 -	Voltage pulses from ignition coil term. 1	1 <==> 5	Shift to neutral, start.	Ignition pulses on oscilloscope	B 09
2	6 -	Voltage from control relay term. 87	9 <==> 5	Shift to neutral, start.	8...15 V	B 11
3	7 -	Voltage from starting motor term. 50	4 <==> 5	Shift to neutral, start.	8...15 V	B 13
4	 V 11	Resistance of temperature sensor NTC I in air-flow sensor term. 8	8 <==> 5	none	100...200 Ω	B 15
5	 V 12	Resistance of potentiometer in air-flow sensor term. 7	7 <==> 5	Deflect sensor flap as far as it will go.	60...1000 Ω	B 17
6	 V 13	Resistance of temperature sensor NTC II term. 10 (engine temperature)	10 <==> 5	(+ 15° C...+ 30° C) (+ 80° C)	1,45...3,3 k Ω 280...360 Ω	B 19
7	 V 14	Resistance of output stage ground term. 13	13 <==> 5	none	0...10 Ω	B 21
8	 V 16	Resistance of idle contact in throttle-valve switch term. 2	2 <==> 9	Accelerator in rest position Accelerator slightly depressed	0...10 Ω infinity Ω	B 23
9	 V 17	Resistance of full-load contact in throttle-valve switch term. 3	3 <==> 9	Accelerator in rest position Accelerator in full-load position	infinity Ω 0...10 Ω	C 01
10	 V 18	Resistance of all 4 parallel-connected injection valves term. 12	12 <==> 9	(+ 15° C...+30° C) (+ 80° C)	7,0...9,5 Ω 7,2...10,0 Ω	C03

TEST SPECIFICATIONS

C a u t i o n:

The Coordinates given on the right refer to the section within a trouble-shooting program in which this component is checked. After checking, do not continue in that trouble-shooting program, but continue in the test specifications section or in the trouble-shooting chart.

Pressure regulator

* Fuel pressure 2,3...2,7 bar

Electric fuel pump

* Fuel delivery (measured in return) min. 700 cm³ /30s
* Terminal voltage (under load): min. 12 V

Temperature sensor II

(Engine) Color of plug blue
* Electrical internal resistance at ambient temperature (+ 15° C...+ 30° C): 1450...3300 Ω
with engine at op. temp. (approx. + 80° C): 280...360 Ω

Solenoid-operated injection valve

* Electrical internal resistance at ambient temperature (+ 15° C...+ 30° C): 15,0...17,5 Ω

Air-flow sensor

* Electrical internal resistance between:
Term. 8 and 5: 340... 450 Ω
Term. 7 and 5: 60...1000 Ω (+)
Term. 8 and 9: 160... 300 Ω
Term. 9 and 5: 500... 760 Ω
(+) Deflect sensor flap as far as it will go.

Auxiliary-air device

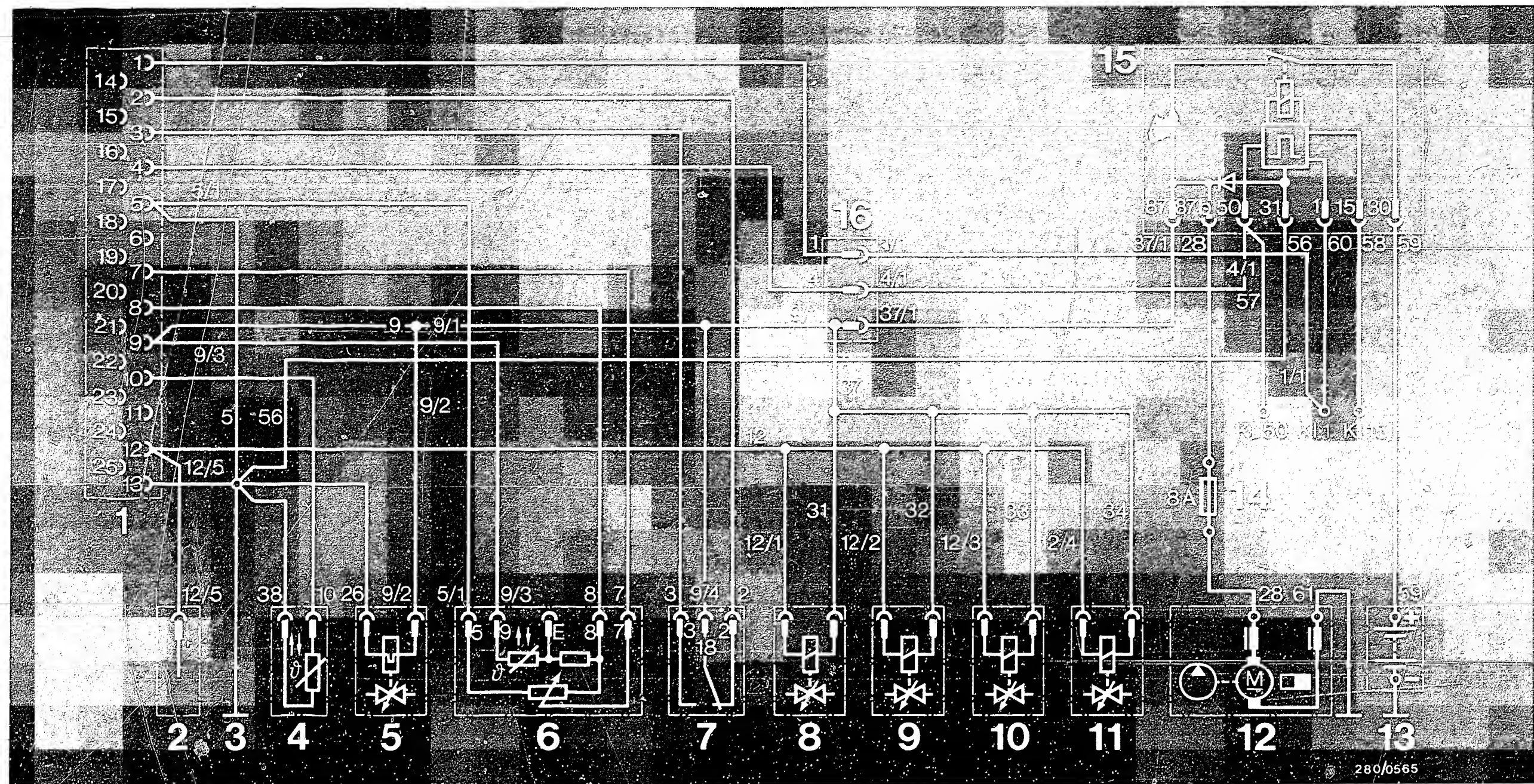
* Electrical internal resistance 30...65 Ω

Idle adjustment

* Idle speed
Manual transmission (Europe): 850...900 min⁻¹
Manual transmission (Sweden/Switzerland): 900...950 min⁻¹
5-speed manual transmission (Europe): 900...950 min⁻¹
Automatic transmission: 800...850 min⁻¹

* CO concentration
With engine at op. temp.
European version: 0,5...1,5 vol % CO
Sweden and Switzerland versions: max. 0,3 vol % CO

See equipment and Autodata microcards for settings for ignition, valve clearance and other engine data.

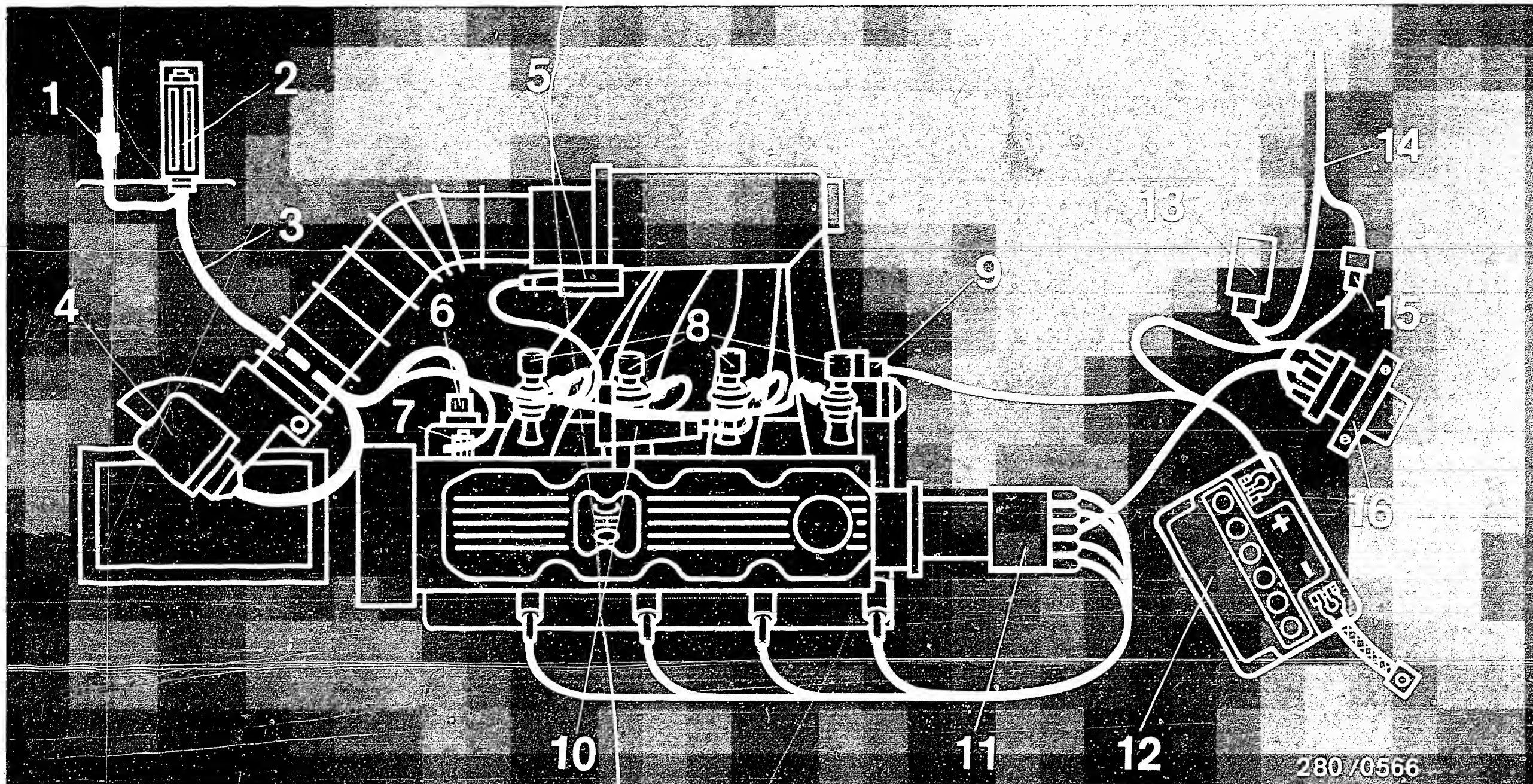


ELECTRICAL TERMINAL DIAGRAM

1 = Control-unit plug
 2 = Trip computer
 3 = Central ground for output stage and electronics

4 = Temperature sensor II (engine temperature)
 5 = Auxiliary-air device
 6 = Air-flow sensor
 7 = Throttle-valve switch

8,9,10,11= Injection valves
 12= Electric fuel pump
 13= Battery
 14= Pump fuse
 15= Control relay
 16= 3-pin plug connector

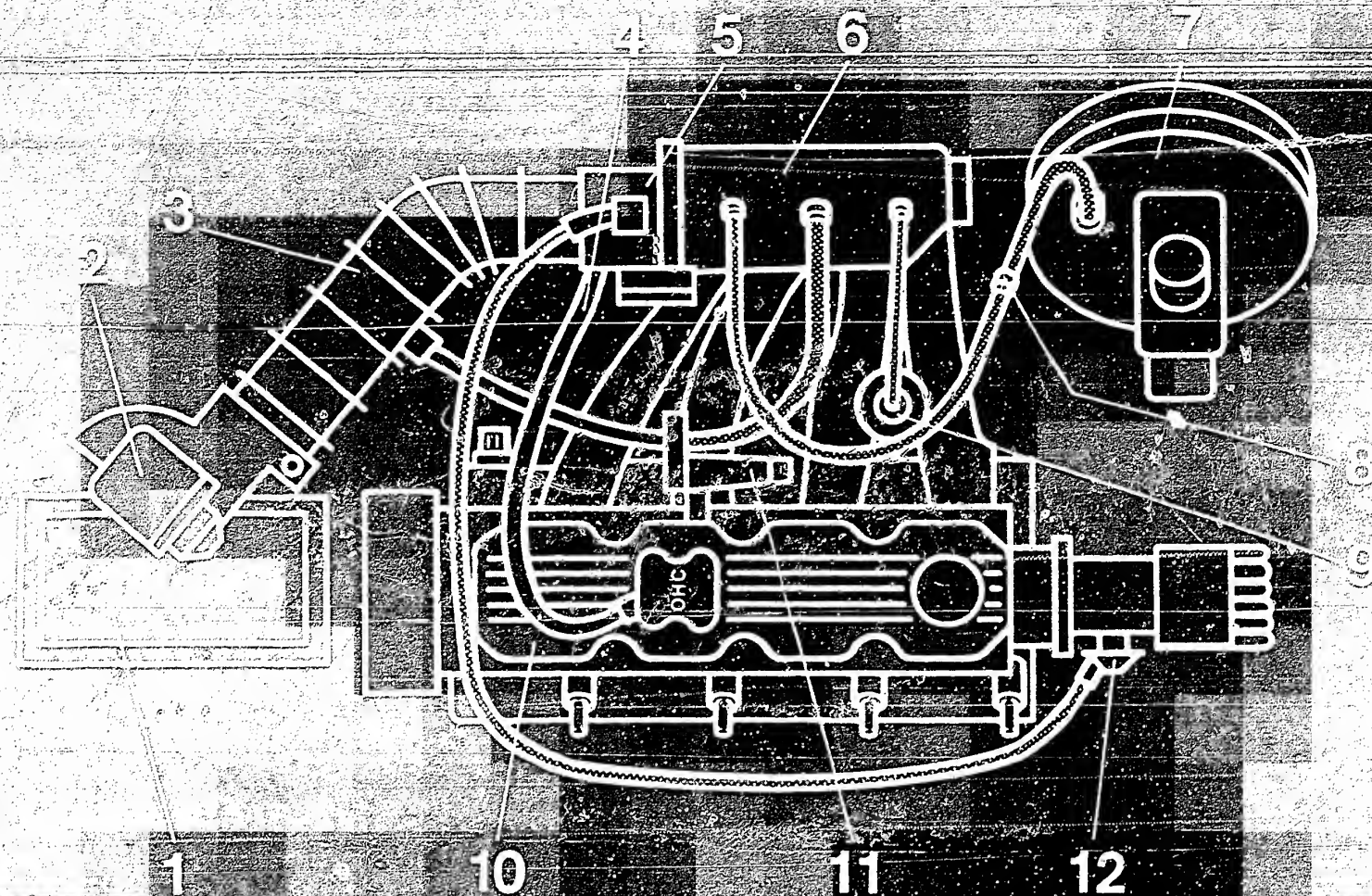


ELECTRICAL WIRING DIAGRAM AND ARRANGEMENT OF INDIVIDUAL COMPONENTS

1 = Plug connector term. 1
 2 = Control unit
 3 = Jetronic wiring harness
 4 = Air-flow sensor
 5 = Throttle-valve switch

6 = Temperature sensor II
 7 = Central ground
 8 = Injection valves
 9 = Starting motor
 10 = Auxiliary-air device

11 = Ignition distributor
 12 = Battery
 13 = Control relay
 14 = Vehicle wiring harness
 15 = 3-pin plug connector
 16 = Ignition coil



280/0567

DIAGRAM OF AIR LINES

 = Intake manifold pressure

 = Atmospheric pressure

- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Air-guide hose
- 4 = Crankcase ventilation
- 5 = Throttle-valve assembly
- 6 = Intake manifold

- 7 = Brake booster
- 8 = Non-return valve
- 9 = Pressure regulator
- 10 = Valve cover
- 11 = Auxiliary-air device
- 12 = Ignition advance unit

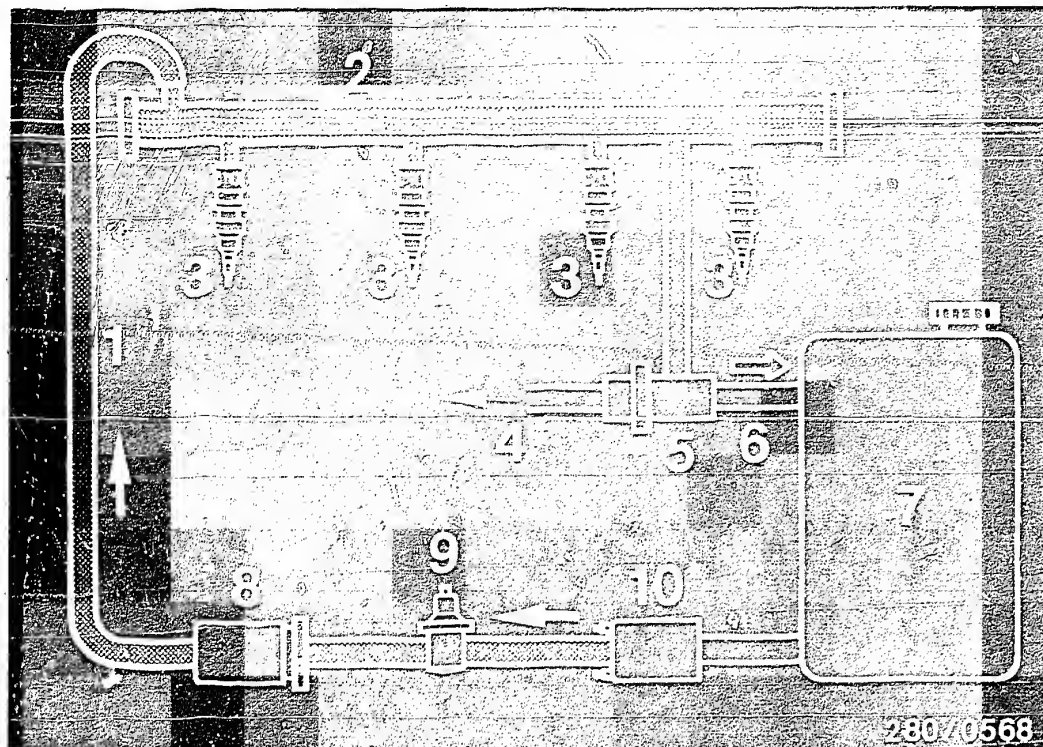
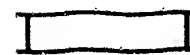



DIAGRAM OF FUEL LINES

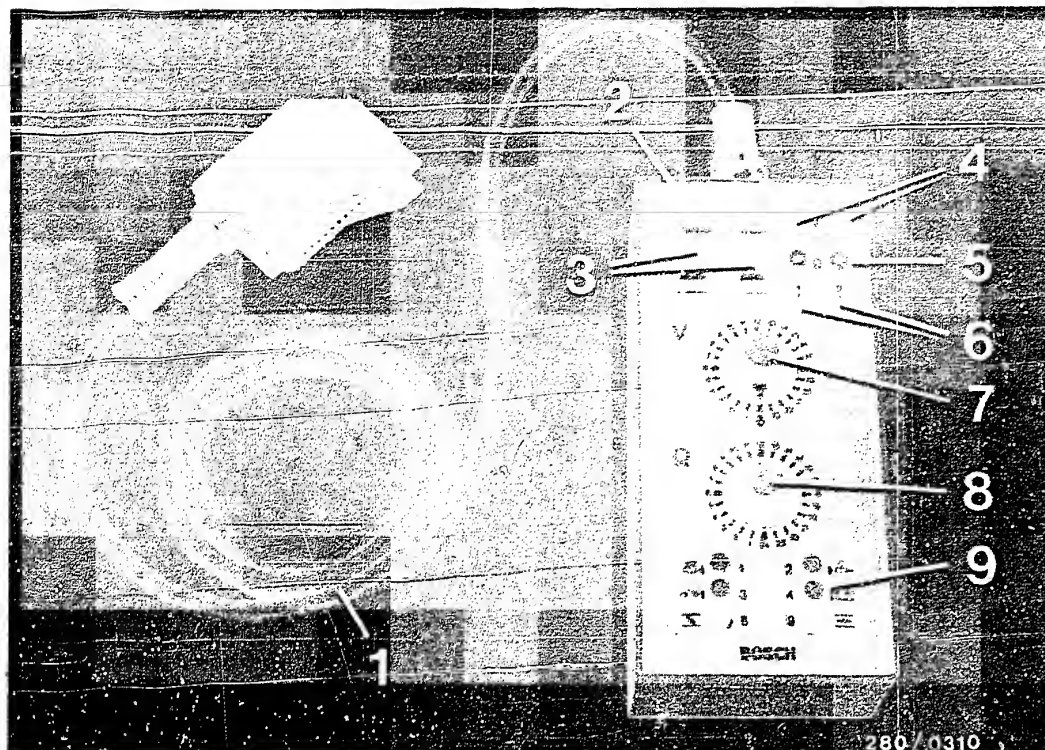
 = Pressureless
 = Fuel pressure

- 1 = Fuel delivery line
- 2 = Fuel-distribution pipe
- 3 = Injection valves
- 4 = Intake manifold pressure connection
- 5 = Pressure regulator
- 6 = Fuel return line
- 7 = Fuel tank
- 8 = Fuel filter
- 9 = Pressure damper
- 10 = Electric fuel pump

TEST EQUIPMENT AND TOOLS

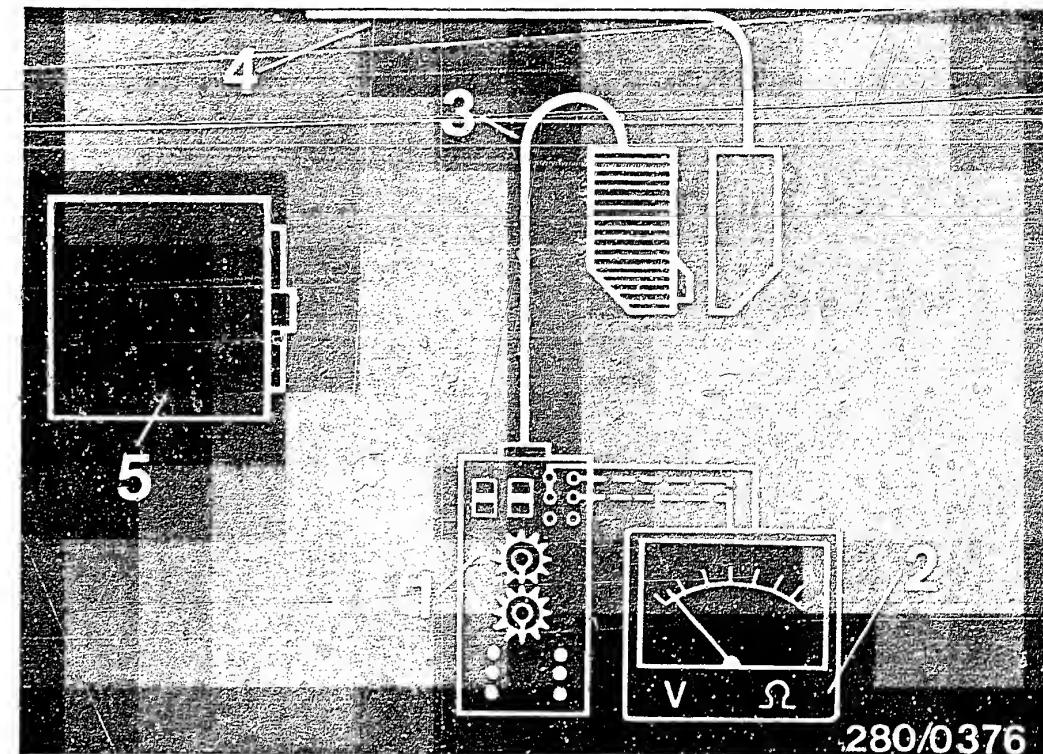
<u>Description</u>	<u>Designation</u>	<u>Part Number</u>
Universal test adapter	ETT 018.01	0 684 101 801
Adapter lead		1 684 463 123
Motortester	e.g. MOT 002.00 MOT 300 MOT 400	0 684 000 200 0 684 000 300 0 684 000 400
Test lead		1 684 463 093
Exh. gas analyzer	e.g. ETT 008.00 ETT 008.04 ETT 008.05	0 684 100 800 0 684 100 804 0 684 100 805
Pressure tester e.g. pressure gauge	Quality class 1.0 Msg. range 6 bar 0.1 bar graduations	1 687 231 154
Pressure tester Pressure tester (no longer available)		KDJE-P 100
Three-way line		KDEP 1034 KDJE-P 100/13
Electrics tester or multimeter e.g.	ETE 014.00 Philips Miselco Fluke	0 684 101 400 PM 2517 X Master 50 K Multimeter 75
Hexagon-socket-screw key	AF 5	
Solenoid-operated injection valve		0 280 150 205 #

Use suitable commercially available tools for removing and fitting the idle CO anti-tamper device on the air-flow sensor.



UNIVERSAL TEST ADAPTER WITH ADAPTER LEAD

- 1 = Adapter lead
(Part No.:
- 2 = Universal test adapter
(Part No.: 0 684 101 801)
- 3 = Test wells (for motortester)
- 4 = Test sockets (for voltage measurements)
- 5 = Test sockets (for resistance measurements)
- 6 = Test sockets (not yet assigned)
- 7 = "V" program switch
- 8 = "Ω" program switch
- 9 = Button panel (not used for -Jetronic)
version)



- 1 = Universal test adapter
- 2 = Multimeter
- 3 = LE adapter lead
- 4 = Jetronic wiring harness
- 5 = LE control unit

Connection:

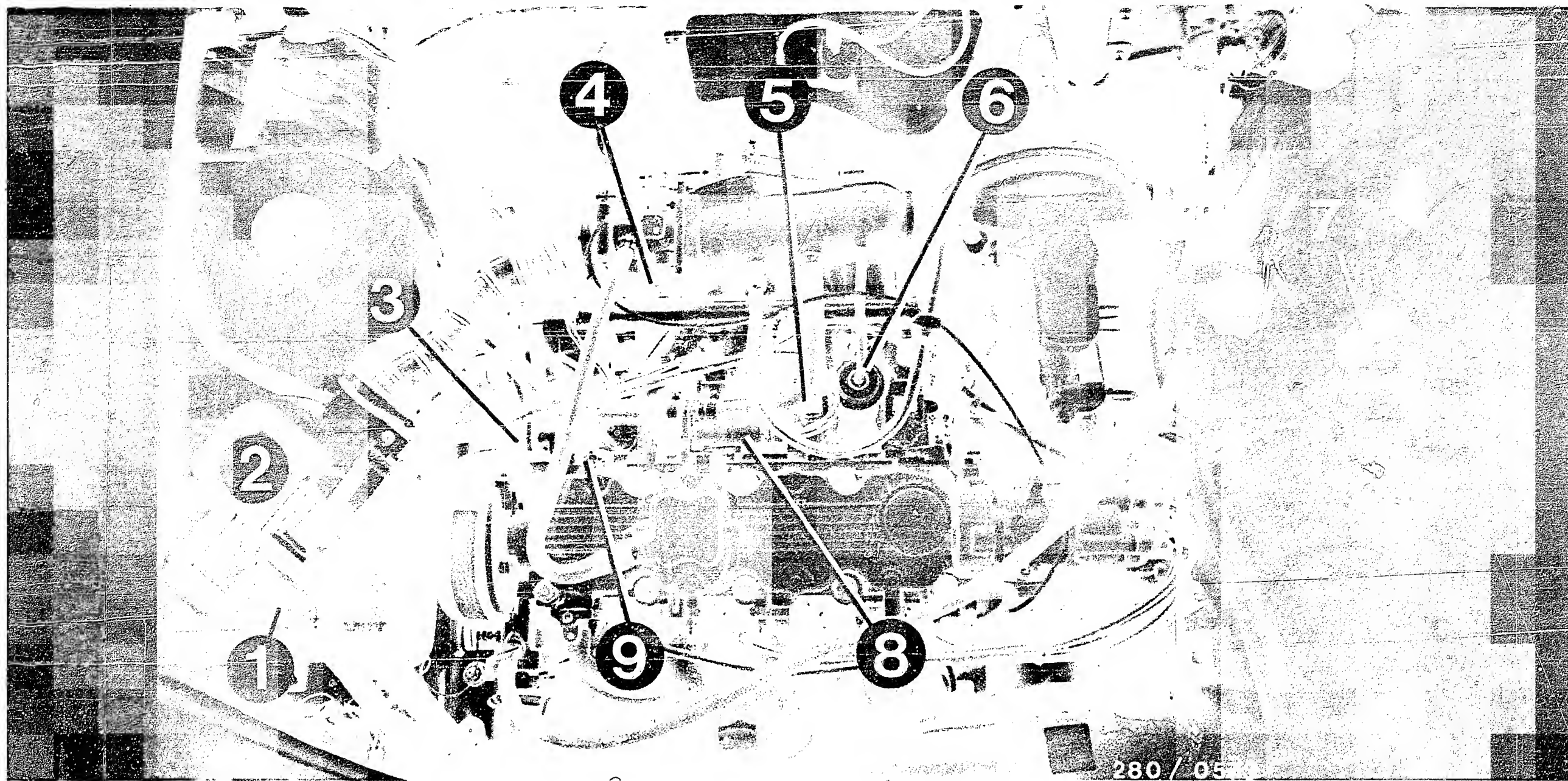
Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead.

C A U T I O N:

Connect and disconnect the universal test adapter only with the ignition off.

Testing:

For testing, connect a multimeter with $R_{\text{min.}} 20 \text{ k} \Omega / \text{V}$ to the test adapter. In addition, the signal from term. 1 of the ignition coil or from term. t_p of the ignition trigger box can be measured with a motortester through the special input.



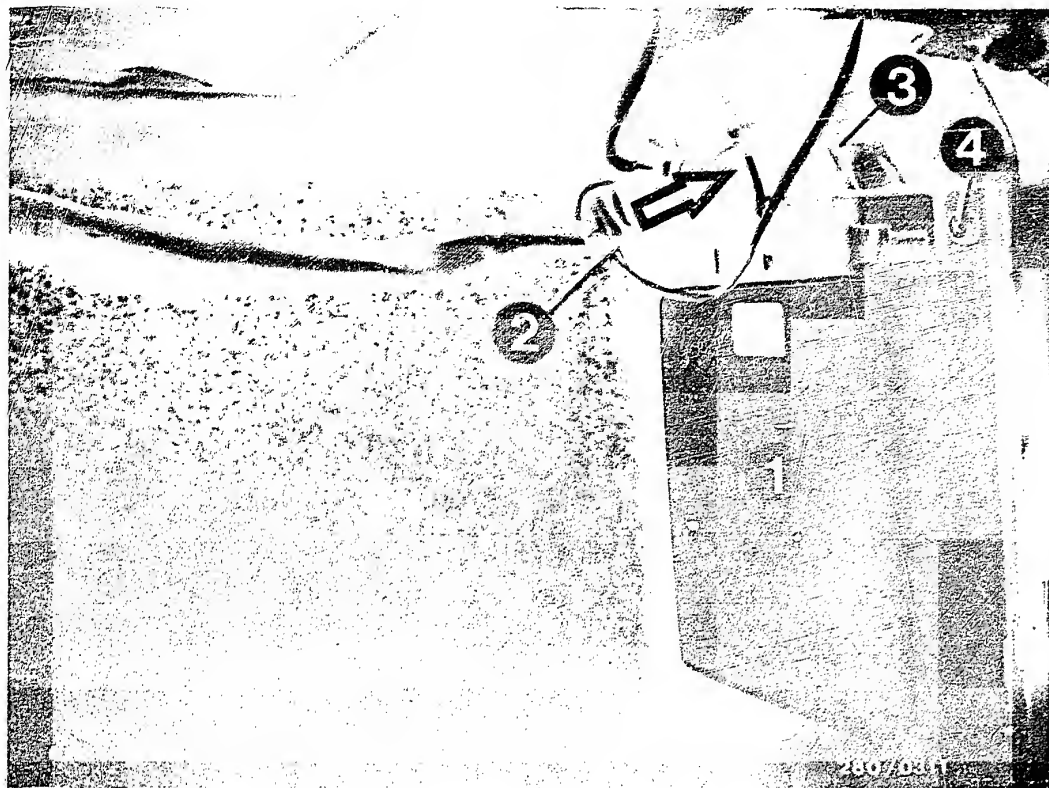
INSTALLATION POSITION OF COMPONENTS

* Arrangement of components on engine

1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II

4 = Throttle-valve switch
5 = Injection valves
6 = Pressure regulator

7 = Control relay
8 = Auxiliary-air device
9 = Central ground



- 1 = Control unit
- 2 = Plug connector term. 1
- 3 = 25-pin control-unit plug
- 4 = Fastening screws

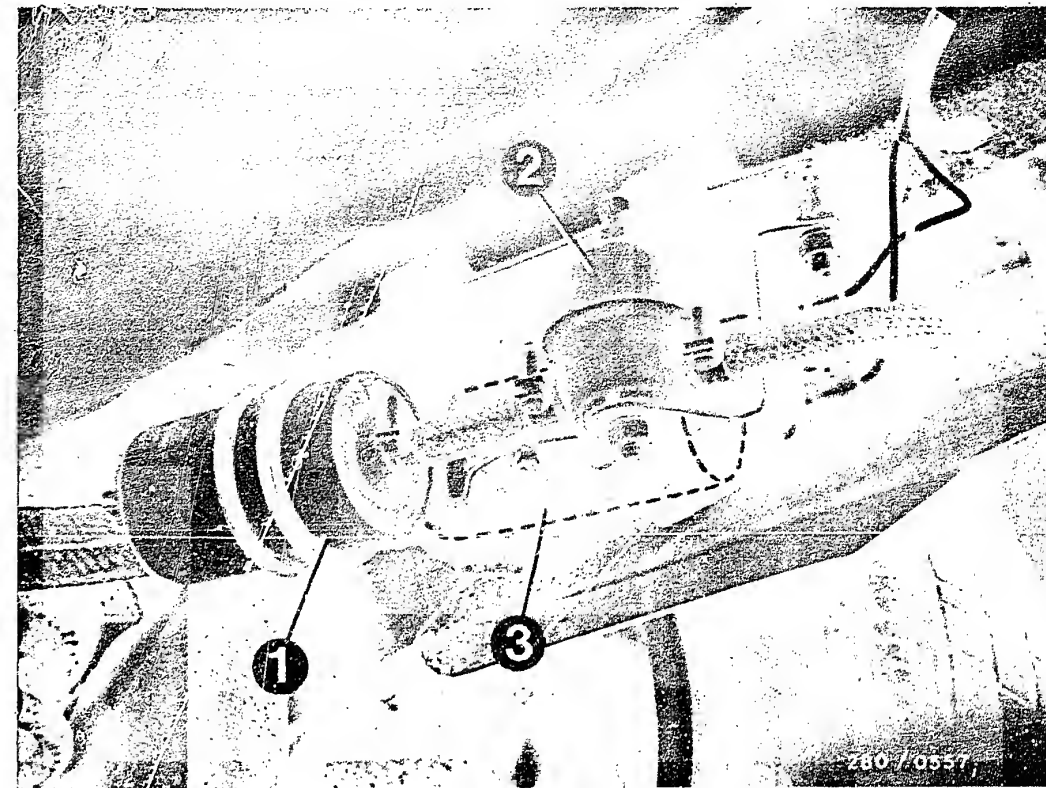
* Control unit in passenger compartment

The indications "right" and "left" always apply as viewed in the forward direction of travel.

The control unit is in the passenger compartment, front-passenger side, in the footwell at the bottom right. #

#

To connect the universal test adapter, disconnect control-unit plug (25-pin). To do this, press the detent in the direction of the arrow.



- 1 = Fuel filter
- 2 = Pressure damper
- 3 = Electric fuel pump, protected against dirt by holding plate (Partially hidden in picture).

* Fuel-supply components

All three components are on the underside of the vehicle to the right of the fuel tank. #

#

IMPORTANT GENERAL INFORMATION

- * Never start the engine without the battery connected.
- * Do not use a starting aid with more than 16V.
- * Never disconnect battery with engine running.
- * To fast-charge the battery, disconnect it from the vehicle electrical system.
- * Remove the control unit at temperatures above 80°C (paint-drying installation).
- * Make sure that all connectors of the wiring harness are correctly seated.
- * Never disconnect or connect the control-unit plug with the ignition on.
- * When testing compression, cut the power supply by disconnecting the control relay. This prevents undesired injecting.
- * Remove the Jetronic control unit before performing electrical welding work (e.g. spot-welding).
- * If an alarm system is installed, proceed according to SIS microcard ALL-500.
- * In the following trouble-shooting, it is assumed that engine, ignition and electrical system are O.K.
- * Additional information on L-Jetronic:
 - VDT - U3/3
 - VDT-I-280/...

For production reasons:
continued on the following
coordinate.

TROUBLE-SHOOTING CHARTS

Using the universal test adapter with adapter lead (1 684 463 123) and other suitable test equipment, the following trouble-shooting charts are intended to enable the workshop employees to quickly detect causes of trouble on the LE-Jetronic. A choice can be made between the following working procedures, depending on the level of training and experience of the mechanic.

* Detailed, step-by-step trouble-shooting chart

For employees with little practice or experience on LE-Jetronic vehicles.

| B03 |

Each customer complaint is assigned its own complete trouble-shooting program.....

* Direct, pin-pointed trouble-shooting chart

For trained, experienced employees with a great deal of practice on LE-Jetronic vehicles.

| B05 |

For each customer complaint, you start with a specific component of your choice within the trouble-shooting program.....

Both trouble-shooting charts begin by checking the electrical/electronic part of the LE-Jetronic using the universal test adapter with adapter lead. This quickly checks the electrical operation of the wiring harness with the components connected to it, and faults are soon detected.

If no fault is found with the universal test adapter, it is necessary to perform the fuel pressure test.

If once again no fault is found, continue with the detailed o r the direct trouble-shooting chart.

1. Detailed, step-by-step trouble-shooting chart for the complete trouble-shooting program

* Electrical test with universal test adapter, adapter lead 1 684 463 123 and motortester/multimeter

This test must come at the start of the testing program and must be performed from beginning to end (Coordinates B07...C04)

* Fuel pressure test with pressure gauge

This test must come directly after the test with the universal test adapter and must be performed from beginning to end (Coordinates C05...C14)

* Trouble-shooting according to customer complaints (fault symptoms)

The following table contains possible fault symptoms and the right-hand column gives the first coordinate of the relevant detailed trouble-shooting program.

This trouble-shooting program consists of logically ordered test procedures for all individual components of the LE-Jetronic. If, after completing the trouble-shooting program for an assumed symptom, the fault has not been detected or remedied, choose a new fault symptom and work through another program.

<u>Customer complaints</u> (Fault symptoms)	<u>Electrical test with universal test adapter</u>	<u>Fuel pressure test with pressure gauge</u>	<u>Trouble-shooting program</u>
1. Starting motor operates, engine fails to start	B07	C05	C15
2. Engine starts but then dies	B07	C05	D07
3. Rough idle/incorrect idle speed	B07	C05	D15
4. Poor throttle take-up	B07	C05	E13
5. Engine missing under all operating conditions	B07	C05	F07
6. Fuel consumption too high	B07	C05	G11
7. Max. engine power/top speed not reached	B07	C05	G21
8. Idle speed and CO concentration too low or too high	B07	C05	H11

2. DIRECT, PIN-POINTED TROUBLE-SHOOTING CHART, FOR COMPONENTS WITHIN THE TROUBLE-SHOOTING PROGRAM

* Electrical test with universal test adapter, adapter lead 1 684 463 123 and motortester/multimeter

The test with the universal test adapter must come at the start of the testing program and must be performed from beginning to end. (Coordinates B07...C04).

* Fuel pressure test with pressure gauge

The fuel pressure test must come directly after the test with the universal test adapter and must be performed from beginning to end. (Coordinates C05...C14).

* Trouble-shooting according to customer complaints

The following table contains various fault symptoms with several possible causes of the fault in each case. The coordinate reference panel indicates the first coordinate of the testing procedure for the particular component of the LE-Jetronic. If, after testing the individual components, the fault has not been detected or remedied, choose a new fault symptom.

Customer complaints (Fault symptoms)

1. Starting motor operates, engine fails to start or starts only with great difficulty								
2. Engine starts but then dies								
3. Rough idle/incorrect idle speed								
4. Poor throttle take-up								
5. Engine missing under all operating conditions								
6. Fuel consumption too high								
7. Max. engine power/top speed not reached								
8. Idle speed and CO concentration too low or too high								
								<u>Cause (Component fault)</u>
B07	B07	B07	B07	B07	B07	B07	B07	Fault in electrical test with universal test adapter
C05	C05	C05	C05	C05	C05	C05	C05	Fault in fuel supply, pressure regulator defective, control relay defective, electric fuel pump not operating, fuel pressure test
D23	D09		E17					Auxiliary-air device not opening
		D21					H15	Auxiliary-air device not closing
D01		E05	E19	F11	G15	H05	H19	Air-flow sensor defective, potentiometer test (noise test)
		D23		G01				Vacuum limiter defective (on Sweden version only)
D03	D11							Hot starting troubles - air-intake system or fuel system leaking
C17								Cold-start control defective
D03	D11	E07	F01			H07	H23	Air-intake system leaking
		E01		G07	G13			Injection valves defective; connect test lead
				F17		H03		Insufficient delivery from electric fuel pump
		D17	E15	F23				Throttle valve not closing (check overrun cutoff)
						G23		Throttle valves not opening fully
		E05	E15	F19		H01		Throttle-valve switch defective (adjustment)
		D19	F03		G17		H13	CO exhaust-gas setting too rich, idle adjustment
		E09	F03	G03			H13	CO exhaust-gas setting too lean, idle adjustment, engine coughing
				F19				Control unit defective

TEST CHART FOR UNIVERSAL TEST ADAPTER

with adapter lead 1 684 463 123

for LE-Jetronic

- * Before testing with the universal test adapter, check all multiple plug connections for loose contacts. Clean contacts if dirty or corroded.
- * Watch for blade receptacles that have been pushed back. If necessary, bend back locking tab and press blade receptacle as far as it will go into plug housing; locking tab latches.
- * Suspicion of line breaks in case of kinking and pinching.

The universal test adapter tests only the peripherals of the electrics (not including control unit).

Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead (ignition must be off).

To make the readings, connect a multimeter to the universal test adapter for voltage and resistance measurements, as well as a motortester.

The individual test steps are selected by means of two program switches (one for voltage measurements, the other for resistance measurements). Each program switch has 24 test settings, only some of which, however, are used for the LE-Jetronic.

The test with the universal test adapter must always be performed from the beginning to end, starting at test step 1, and in the given sequence.

Be sure to follow the instructions in the test chart!

- * Test steps 1...3 measure voltages during starting.

Set multimeter to "voltage measuring range".

- * Test steps 4...10 measure resistances.

Set multimeter to "resistance measuring range".

Test specifications and notes on how to operate the universal test adapter are given in the following test chart.

Requirements for correct testing procedure:

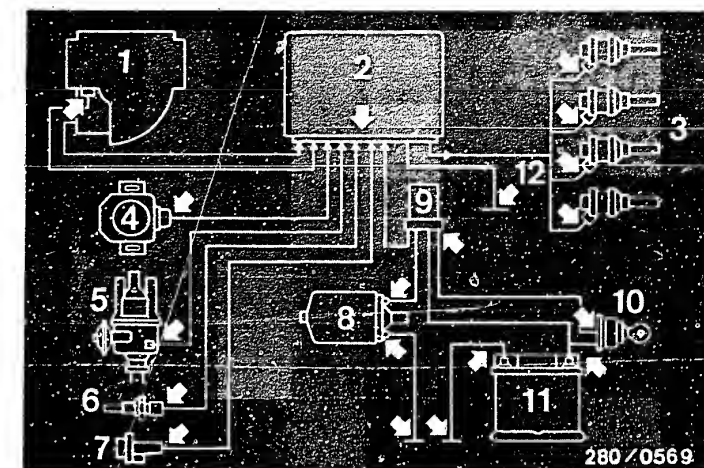
1. The trouble-shooting in each test step builds on the trouble-shooting of the preceding test step.

Example: If, in test step 1, the ground connect term. 5 for the control unit is checked, this is not repeated in the following test steps.

2. If an incorrect reading is indicated for a test step, this test step must be repeated after the fault has been remedied.

Note:

In the following test steps, a frame is drawn around certain passages of text to indicate which operation has to be changed compared with the preceding test step.



Electrical plug-in connections
(Arrows)

- 1=Air-flow sensor
- 2=Control unit
- 3=Injection valves
- 4=Throttle-valve switch
- 5=Ignition distributor
- 6=Temperature sensor II (engine)
- 7=Auxiliary-air device
- 8=Electric fuel pump
- 9=Control relay
- 10=Ignition lock
- 11=Battery
- 12=Central ground

Component / Function:

Signal from term. 1 of
ignition system. Triggering
of control unit.

* Operation:	Setting
Progr. switch " V "	5
Progr. switch " Ω "	1)
Test button	—
1) Switch setting optional.	

* Measuring equipment:
Ignition oscilloscope

* Measuring range:
Special input
Control lever at left-hand
stop
Measuring range 20 V

* Connection:
Test wells

* Operation in vehicle:
Ignition "on" and start

* Test specifications (reading):
Ignition pulses

Are ignition pulses
present?

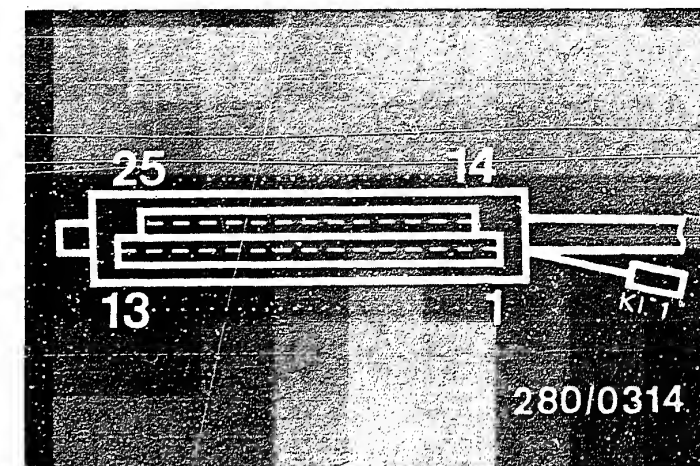
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* Trouble-shooting:

For testing, disconnect
control-unit plug from test
adapter and use circuit
diagram if necessary.

Check the following leads
for continuity with ohm-
meter (specification 0 Ω):

- + From control-unit plug
term. 1 to ignition coil
term. 1
- + From control-unit plug term. 5
to central ground
- + Eliminate contact resistances
at the plug-in connections.



Top view of control-unit plug

Installation position of components:

- * Control unit:
In passenger compartment, front-
passenger side, in footwell at
bottom right.
- * Central ground:
On valve cover at rear right,
near auxiliary-air device.

Continued on next coordinate

Component/Function:

Control unit power supply from
term. 87 of control relay.

* Operation:	Setting
Progr. switch "V"	6
Progr. switch "Ω"	—
Test button	—

* Measuring equipment:
Motortester/multimeter

* Measuring range:
0 ... 15 V

* Connection:
Red test socket (+)
Black test socket (-)

* Operation in vehicle:
Ignition "ON" and start

* Test specification (reading):
8...15 V

Is reading within test specification tolerance?

* Trouble-shooting:

For testing, disconnect
control-unit plug from test
adapter and use circuit
diagram if necessary.

Check the following leads
for continuity with ohm-
meter: (specification
approx. 0 Ω)

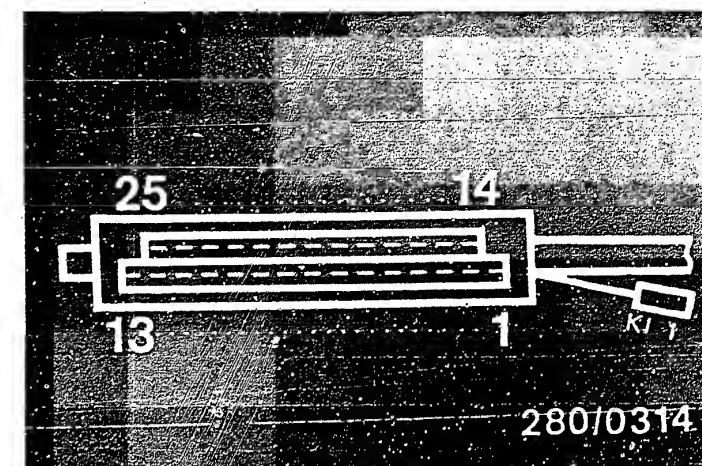
* From control-unit plug
term. 9 to control relay
term. 87

Before continuing, dis-
connect battery

- + From control relay term. 30
to battery (positive terminal)
- + From control relay term. 15
to ignition term. 15.
- + From control relay term. 50
to starting motor term. 50.
- + From control relay term. 31
to central ground.
- + Eliminate contact resistances
at the plug-in connections.
If still no voltage reading →
replace control relay.

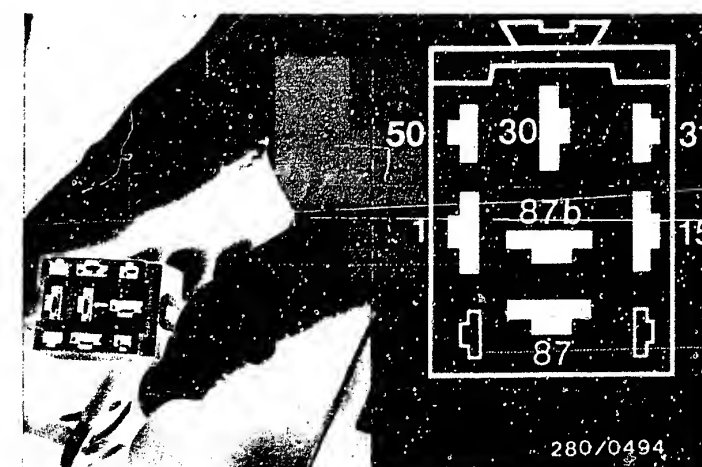
Installation position of components:

- * Control unit:
In passenger compartment, front-
passenger side, in foot-well at
bottom right.
- * Control relay:
In engine compartment on



Top view of control-unit plug

Control relay disconnected.
Top view of plug.



Continued on next coordinate

TEST STEP 3 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component / Function:

Starting signal at control unit from term. 50 of ignition and starting switch.

* Operation:	Setting
Progr. switch " V "	7
Progr. switch " Ω "	—
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:
0 ... 15 V

* Connection:
Red test socket (+)
Black test socket (-)

* Operation in vehicle:
Ignition "ON" and start

* Test specification (reading):
8...15 V

Is reading within test specification tolerance?

N>

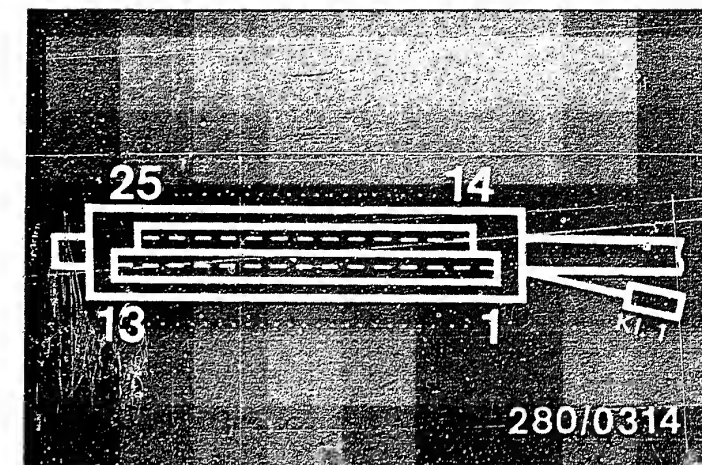
* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohm-meter (specification approx 0 Ω):

+ From control-unit plug term. 4 to control relay term. 50

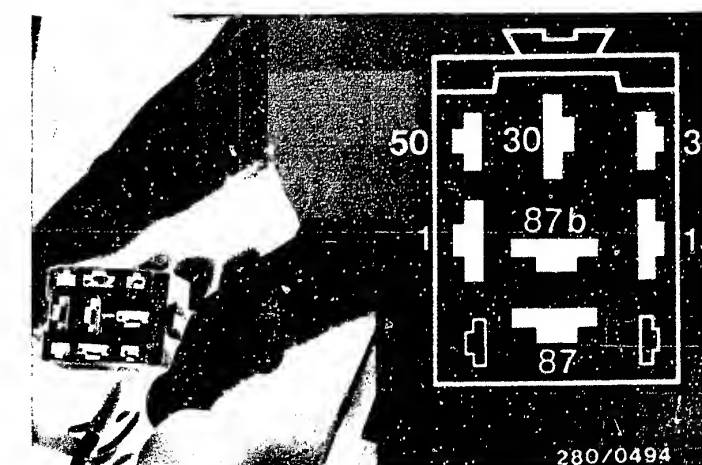
+ Eliminate contact resistances at the plug-in connections

If still no voltage reading
-> check starting system.



Top view of control-unit plug

Control relay disconnected.
Top view of plug.



Installation position of components:

* Control unit:
In passenger compartment, front-passenger side, in foot-well at bottom right.

* Control relay:
In engine compartment on

Continued on next coordinate

Component/Function:

Resistance between air-flow sensor term. 8 and central ground.

* Operation:	Setting
Progr. switch	V \Rightarrow
Progr. switch	Ω 11
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:

x 10 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specification (reading):
100...200 Ω

Is reading within test specification tolerance?

N>

* Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (specification approx. 0 Ω):

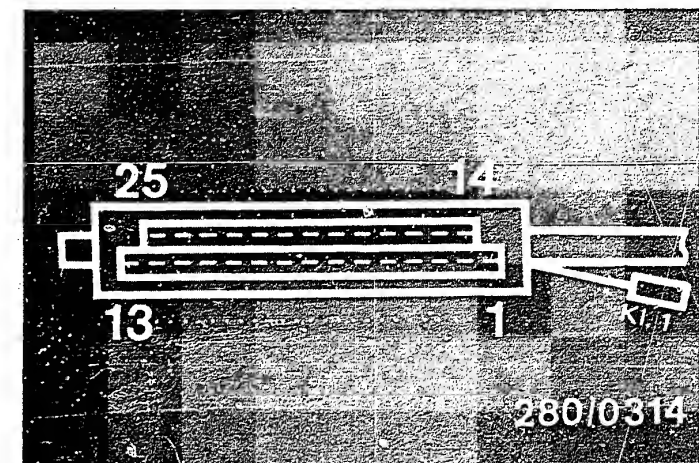
1. Electric fuel pump:

- + From control relay term. 87b through pump fuse to electric fuel pump (positive terminal).
- + From electric fuel pump (negative terminal) to ground connection on body.

2. Air-flow sensor:

- + From control-unit plug term. 8 to air-flow sensor term. 8.
- + From air-flow sensor term. 5 to central ground.
- + From air-flow sensor term. 9 to control-unit plug term. 9.
- + Eliminate contact resistances at the plug-in connections.

If resistance reading still not within tolerance \rightarrow replace air-flow sensor.



Top view of control-unit plug

Installation position of components:

- * Electric fuel pump:
Under vehicle, to right of fuel tank.
- * Air-flow sensor:
In injection compartment in front of right-hand spring strut.
- * Central ground:
On valve cover, at rear right.
- * Pump fuse:
In central fuse box on left under steering wheel.

Continued on next coordinate

Component/Function:

Resistance between air-flow sensor term. 7 and central ground.

* Operation:	Setting
Progr. switch " V "	=>
Progr. switch " Ω "	12
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 10 Ω

* Connection:
Blue test socket

* Operation in vehicle:
Fully deflect sensor flap.

* Test specification (reading):
60...1000 Ω

Is reading within test specification tolerance?

N>

* Trouble-shooting:

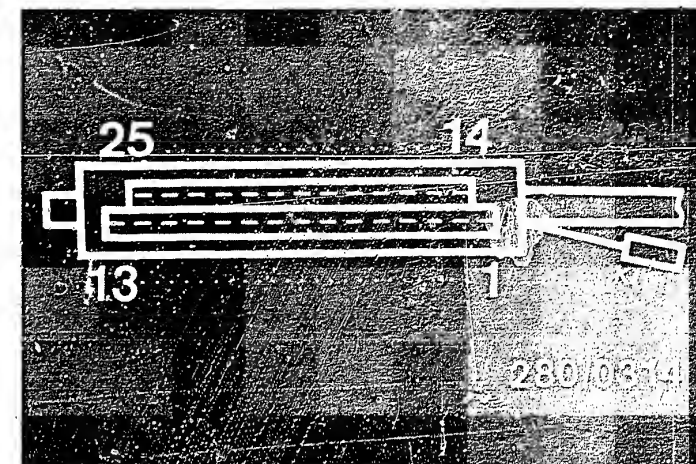
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohm-meter (specification approx. 0 Ω):

+ From control-unit plug term. 7 to air-flow sensor term. 7.

+ Eliminate contact resistances at the plug-in connections.

If resistance reading still not within tolerance -> replace air-flow sensor.



Top view of control-unit plug

Installation position of components:

* Control unit: In passenger compartment, front-passenger side, in footwell at bottom right.

Air-flow sensor:

In engine compartment in front of right-hand spring strut.

Continued on next coordinate

Component/Function:

Resistance between temperature sensor II (engine) term. 10 and central ground.

* Operation:	Setting
Progr. switch " V "	⇒
Progr. switch " Ω "	13
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 10 Ω or x 100 Ω

* Connection:
Blue test socket

* Operation in vehicle:
not applicable

* Test specification (reading):
at ambient temperature
(+15° C...+30° C):
1,45...3,3 k Ω

with engine at op. temp.
(approx +80° C):
280...360 Ω

Is reading within test
specification tolerance?

N>

* Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

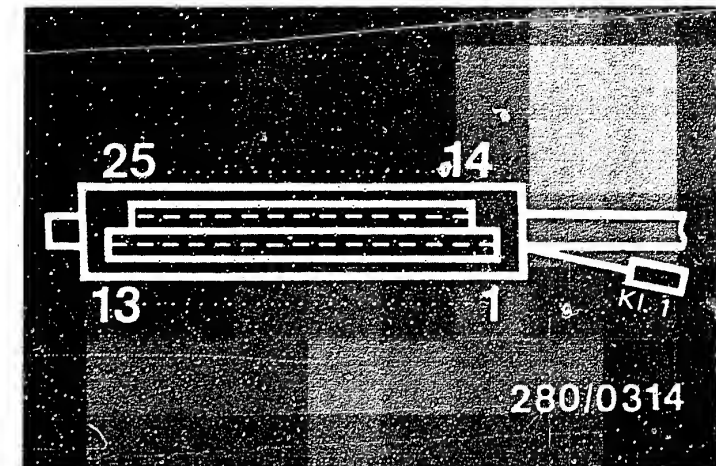
Measure resistance directly at engine temperature sensor II (blue plug).
Ambient temperature
(+15°C...30°C)
1,45...3,3 k Ω
Engine at op. temp. (+80°C)
280...360 Ω

Check the following leads for continuity with ohmmeter (specification approx 0 Ω):

- + From control-unit plug term. 10 to temperature sensor II (engine) term. 10.
- + Lead 38 from temperature sensor II to central ground.
- + Eliminate contact resistances at the plug-in connections.

Installation position of components:

- * Temperature sensor II (engine)
On engine block at rear right (blue plug).
- * Central ground:
On valve cover, at rear right.
- * Control unit:
In front-passenger footwell at bottom right.



Top view of control-unit plug

Continued on next coordinate

Component/Function:

Ground connection of output stage, control unit term. 13.

* Operation:	Setting
Progr. switch * V	⇒
Progr. switch * Ω	14
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range

x 1 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specification (reading)
0...10 Ω

Is reading within test specification tolerance?

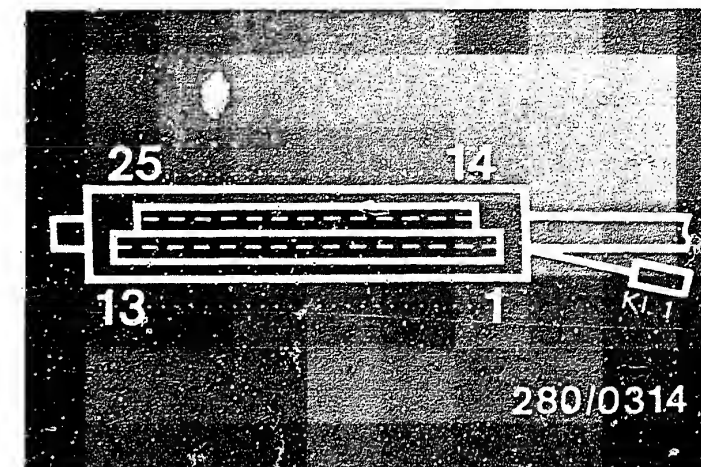
N>

* Trouble-shooting:

For testing, disconnect control-unit plug and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (specification approx 0 Ω):

- + From control-unit plug term. 13 to central ground.
- + Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

Installation position of components:* Control unit:

In passenger compartment, front-passenger side, in footwell at bottom right.

* Central ground:

On valve cover at rear right, near auxiliary-air device.

Continued on next coordinate

Component/Function:

Idle contact of throttle-valve switch term. 2

* Operation:	Setting
Progr. switch \square V	\Rightarrow
Progr. switch \square Ω	16
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 1 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
Accelerator in rest position

* Test specification (reading):
0...10 Ω

Is reading within test specification tolerance?

* Trouble-shooting:

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Adjusting the throttle-valve switch (on intake manifold at front)

Slightly loosen fastening screws. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch in a counterclockwise direction until the idle contact closes (microswitch clicks audibly).

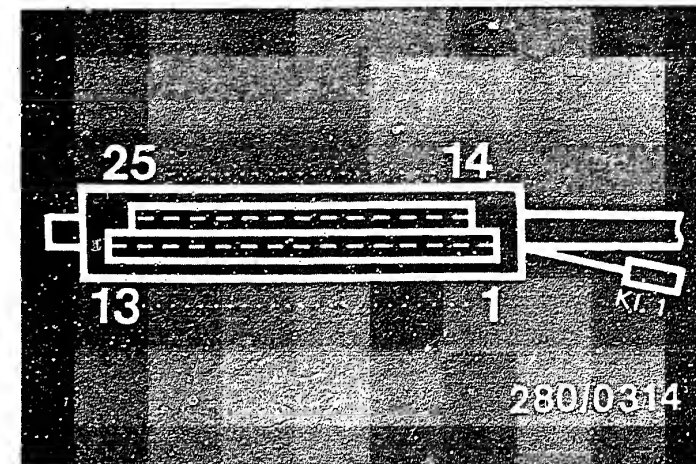
Reading 0 Ω . If not \rightarrow replace throttle-valve switch.

Checking the adjustment:

Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading: infinity Ω .

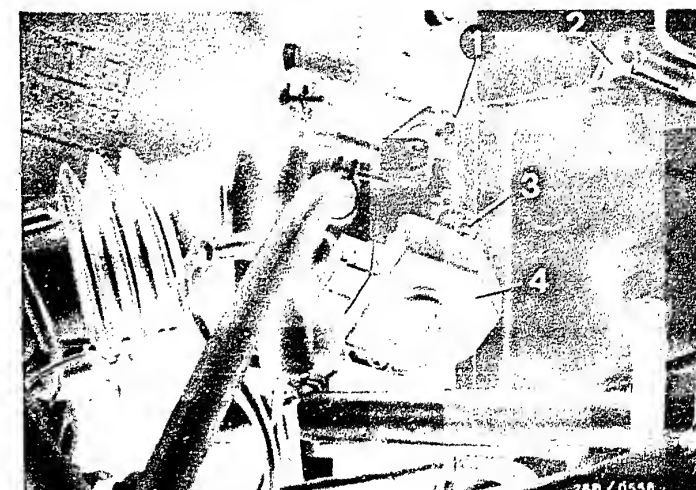
Check the following leads for continuity with ohmmeter (specification approx 0 Ω):

- + From control-unit plug term. 2 to throttle-valve switch term. 2.
- + From throttle-valve switch term. 18 to control-unit plug term. 9.
- + Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

- 1 = Throttle-valve stop screw
- 2 = Throttle lever
- 3 = Fastening screws
- 4 = Throttle-valve switch



Continued on next coordinate

V

Component/Function:
Full-load contact of throttle-valve switch term. 3

* Operation:	Setting	
Progr. switch " V "	=>	
Progr. switch " Ω "	17	
Test button	—	

N>

*** Measuring equipment**
Motortester/multimeter

*** Measuring range:**
x 1 Ω

*** Connection:**
Blue test sockets

*** Operation in vehicle:**
Accelerator fully depressed

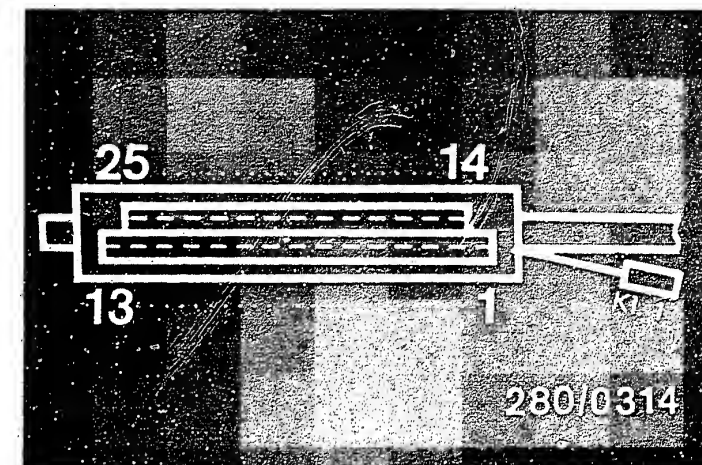
*** Test specification (reading):**
0...10 Ω

Is reading within test specification tolerance?

*** Trouble-shooting:**
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

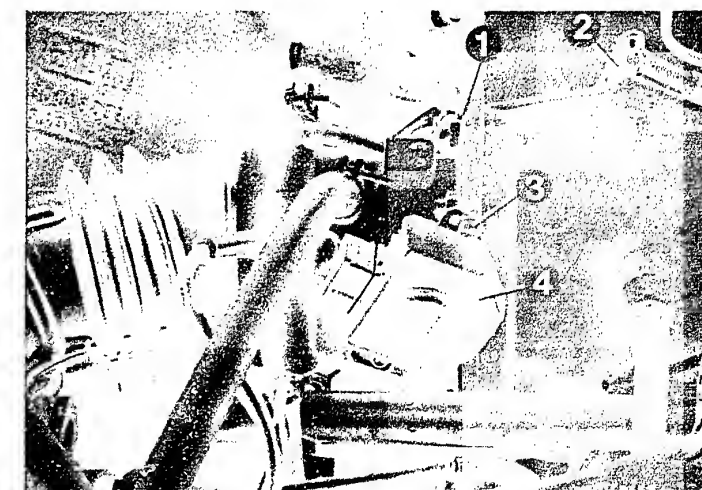
Check the following leads for continuity with ohmmeter (specification approx. 0 Ω):

- + From control-unit plug term. 3 to throttle-valve switch term. 3.
- + Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

- 1 = Throttle-valve stop screw
- 2 = Throttle lever
- 3 = Fastening screws
- 4 = Throttle-valve switch



V

Continued on next coordinate

Component / Function:

Resistance of all injection valves (4 in parallel) term. 12

* Operation:	Setting
Progr. switch V	==>
Progr. switch Ω	18
Test button	—

* Measuring equipment:
Motortester/
multimeter

Measuring range:
x 1 Ω

Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specifications (reading):
at
+15°C...+30°C: 7,0... 9,5 Ω
at +80°C: 7,2...10,0 Ω

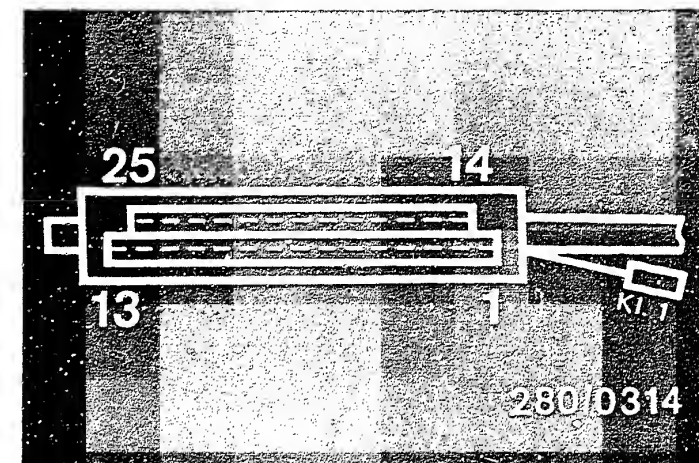
Is reading within test
specification tolerance?

*** Trouble-shooting:**

For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

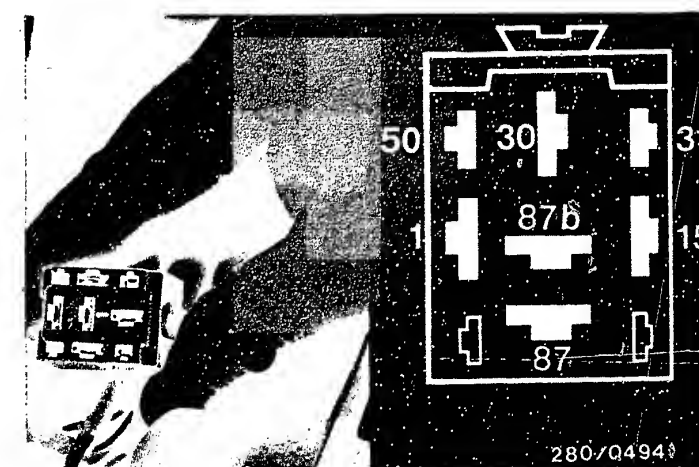
Check the following leads for continuity with ohmmeter (specification approx 0 Ω):

- + From control-unit plug term. 12 to the injection valves.
- + From the injection valves to control relay term. 87.
- + Resistance measurement at individual injection valves:
At ambient temperature (+15°C...+30°C): 15...17,5 Ω
With engine at op. temp. (approx.+80°C): 17...20,0 Ω
If reading too high: open circuit in valve coil or a valve connector has dropped off.
Check contacts for security.
Eliminate contact resistances.
If necessary, replace injection valve(s).



Top view of control-unit plug

Control relay disconnected.
Top view of plug.



Test with universal test adapter now completed.

Now perform the
fuel pressure test.
On the following coordinates.

Fuel pressure test

Electric fuel pump operating?
(Listen)

- * Lead from ignition coil term. 1 O.K.?
- * Voltage present at term. 87b and electric fuel pump?
- * Pump fuse O.K.?
- * Ground lead O.K.?

N>

Checking the control relay

Turn round the connection base with control relay connected.

- * Check lead from term. 1 to ignition coil term. 1 for continuity (approx 0 Ω). Start engine.
- * If no voltage at term. 87b, replace control relay.
- * Pump fuse, on left under steering wheel, O.K.?
- If not, -> replace.
- * Voltage at terminals of electric fuel pump min. 12V. If not -> check ground lead. If O.K. -> replace electric fuel pump.

Fuel pressure O.K.?
Pressure regulator O.K.?

Test specification: 2,3...2,7 bar

Test specification obtained?

N>

Checking the fuel pressure

- * Connect pressure gauge/pressure tester to inlet of fuel-distribution pipe.

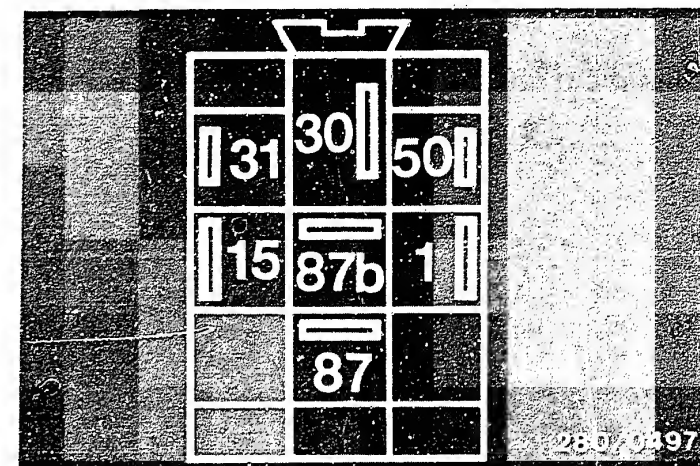
Use 3-way line KDJE-P-100/13.

C A U T I O N :

When disconnecting the fuel hose, make sure that no fuel gets onto hot parts of the engine.

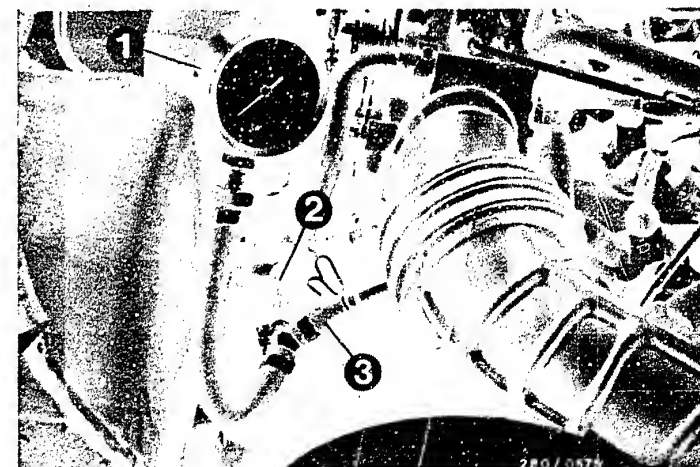
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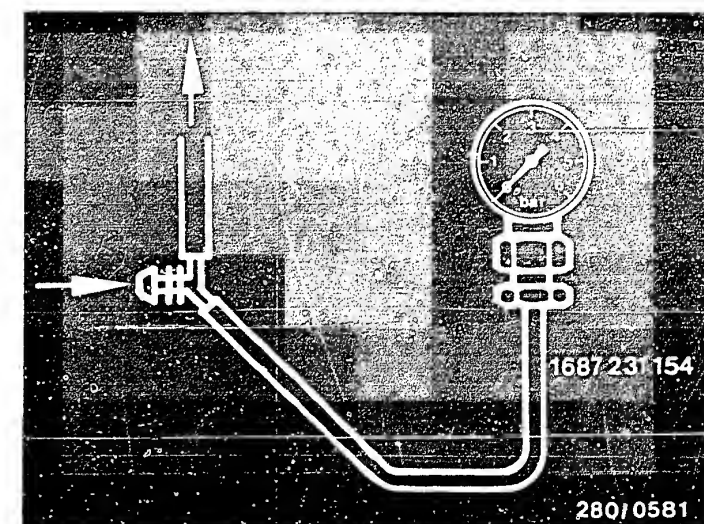
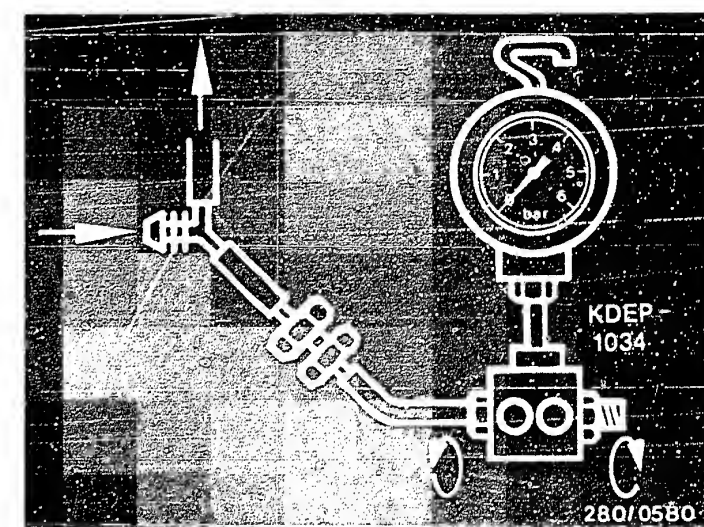
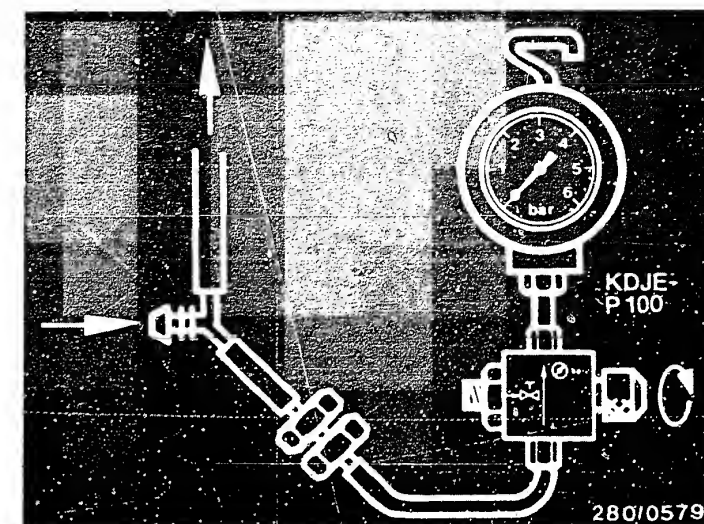
Back of control relay connection base

- 1 = Pressure gauge
- 2 = Fuel delivery line from fuel filter
- 3 = Delivery line to fuel-distribution pipe



Connect connections of pressure tester into the fuel-delivery line. If using pressure tester KDJE-P 100, close the valve screw (only the right-hand screw on KDEP 1034). The end of the hose is connected to the fuel-distribution pipe; the free Y-piece connection is connected to the fuel-delivery hose.

Make sure there are no leaks.



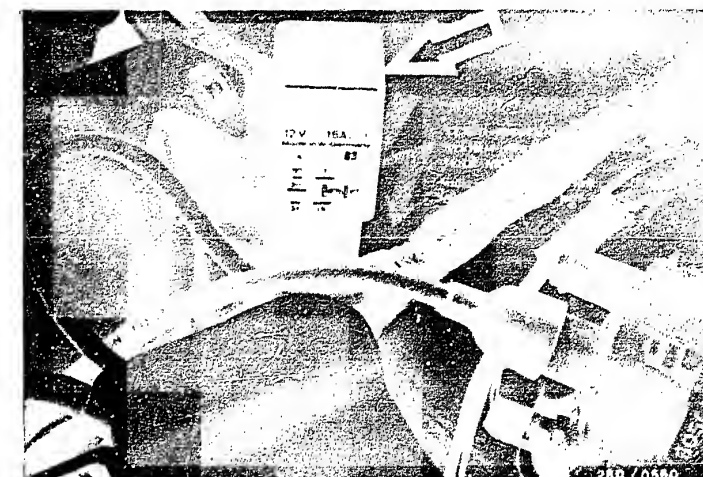
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* Jumping the safety circuit.
Disconnect control relay.
Connect jumper into connection
base between term. 87b and
term. 30. Electric fuel pump
must operate.

Fuel pressure
Test specification: 2,3...2,7 bar

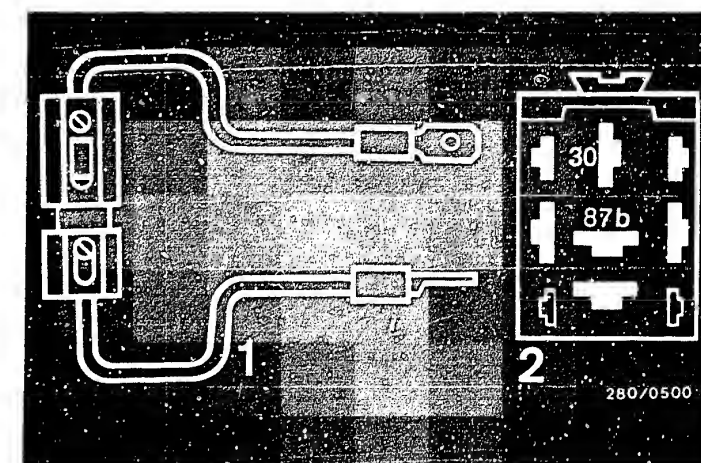
C A U T I O N !
Remove jumper and connect
control relay.
Let engine idle:
fuel pressure approx. 2.0 bar.



Arrow = Control relay on
left-hand spring
strut crown

1 = Jumper with fuse holder
and 10 A fuse (user-
fabricated)

2 = Top view of connection
base



Continued on next picture page

Continued on next picture page

- * Check pressure regulator.
Fuel pressure
Test specification:
2,3...2,7 bar

Fuel pressure of 2,3 bar
not reached:

- * Slowly pinch off fuel return line.
CAUTION !
Do not load pressure gauge above 6 bar.
If pressure rises above 4 bar → replace pressure regulator. The fuel pressure regulator is mounted on the fuel-distribution pipe by a hose-piece.
- * Fuel delivery line, fuel filter or pressure damper clogged.
- * Strainer in tank clogged.
- * Corrosion in tank.

Fuel pressure of 2,7 bar
exceeded:

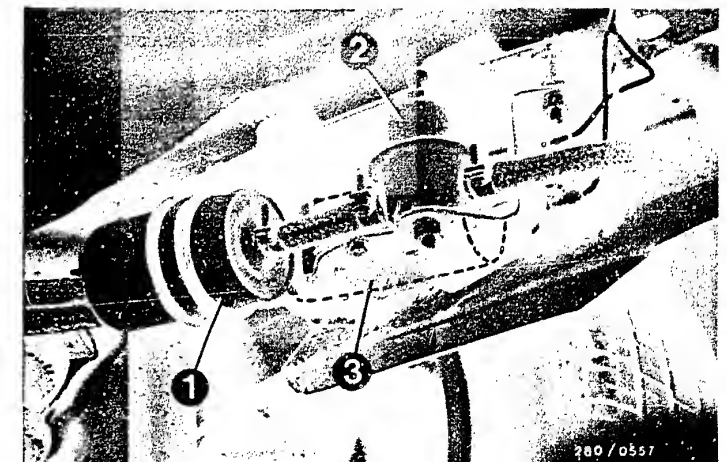
- * Fuel return line clogged or pinched.
- * Replace pressure regulator.

CAUTION !
Be sure to remove jumper after testing is completed and to re-connect the control relay.



1 = Pressure regulator
2 = Injection valve

1 = Fuel filter
2 = Pressure damper
3 = Electric fuel pump
(partially hidden in picture)



Continued on next picture page

Fuel pressure test (continued 4)

Does fuel pressure remain almost constant after engine is switched off?

Test specification: 2,3...2,7 bar

Test specification still obtained after 20 min.?

N>

Fuel pressure quickly drops after switching off the engine while hot.

- * Check fuel system for leaks:
 - Jump safety circuit
 - Fuel pressure 2,3...2,7 bar
 - Remove jumper and watch pressure gauge.
 - After approx 20 min. fuel pressure must still be min. 1.0 bar.

If not:

- * Check for leaks at joints between components and fuel hoses/lines.
- * Pressure regulator (diaphragm)
- * Solenoid-operated injection valves (needle seat, valve not closing correctly)
- * Electric fuel pump (non-return valve leaking)
- * Pressure damper or fuel filter leaking.

Remove pressure gauge. Re-establish connection between fuel delivery line and fuel-distribution pipe. Remove jumper and connect control relay in connection base. The fuel pressure test is completed.

If the fault has not been found or if further instructions are required on how to remedy the fault, continue with the trouble-shooting chart of your choice.

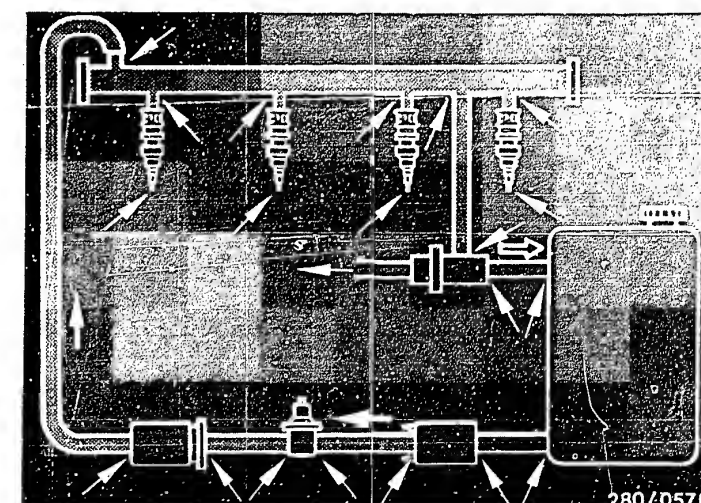
The detailed trouble-shooting chart is on Coordinates B3...B4 and the direct trouble-shooting chart on Coordinates B5...B8.



1 = Pressure regulator
2 = Injection valve

Diagram of fuel lines

Arrows indicate joints between hoses and components.



STARTING MOTOR OPERATES, ENGINE FAILS TO START OR STARTS ONLY WITH GREAT DIFFICULTY

Trouble-shooting program according to customer complaints

Procedure

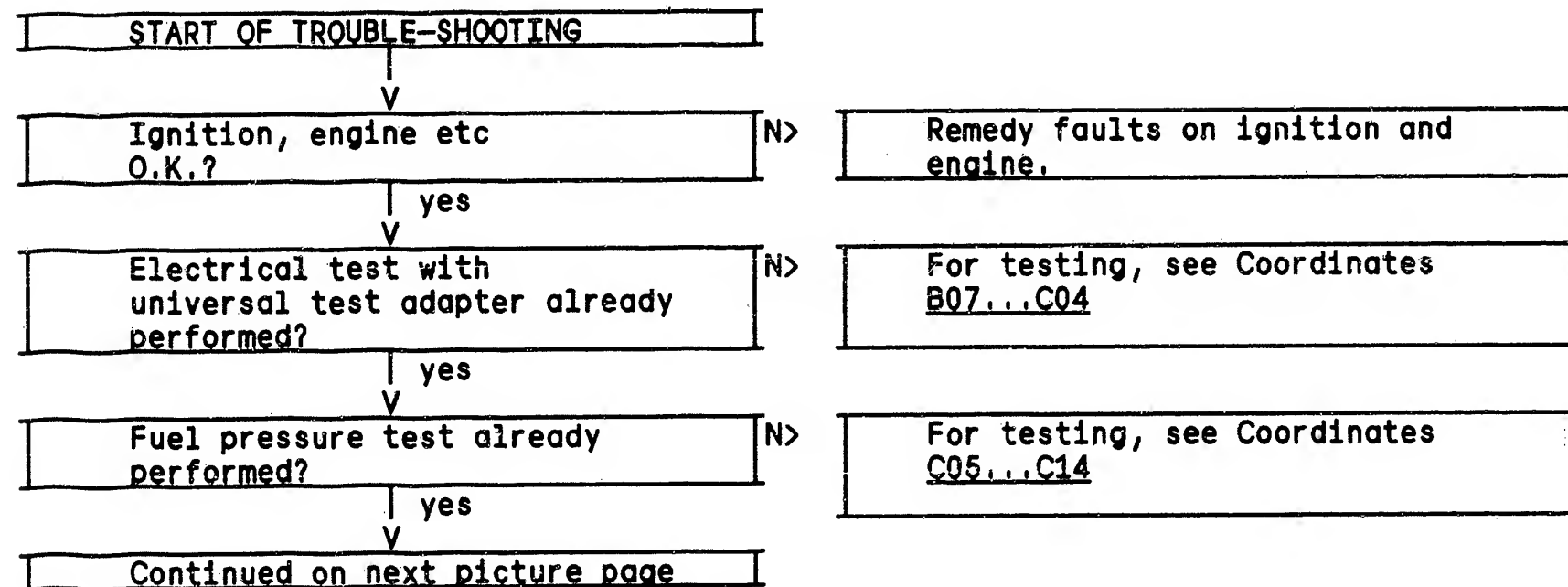
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



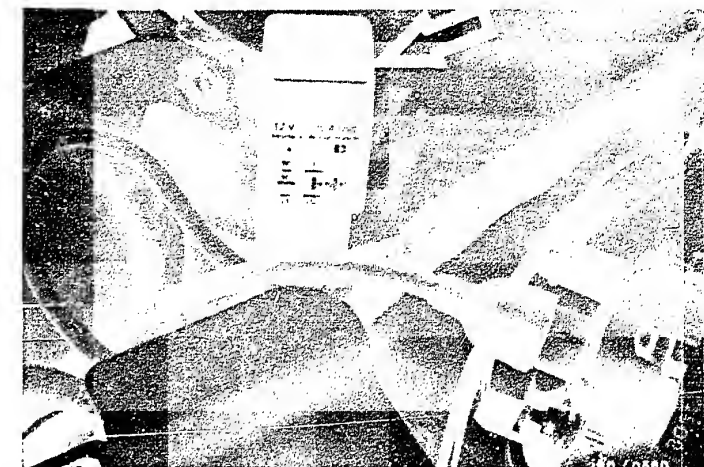
Starting motor operates, engine fails to start (continued 1)

V
Cold-start control O.K.?
(Control unit function)

- N>
- * Does voltage at injection valve drop during starting from approx 7 V to approx 0.5 V? (< 0.5 V if engine at operating temperature)

Functional test:

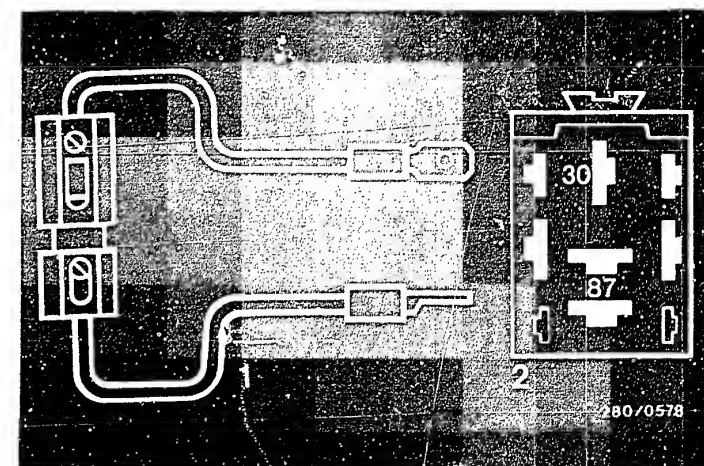
- * Disconnect control relay.
- * Connect jumper into connection base between term. 30 and term. 87. (Power supply to control unit and to injection valves).



Arrow = Control relay on left-hand spring strut crown

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



V
Continued on next picture page

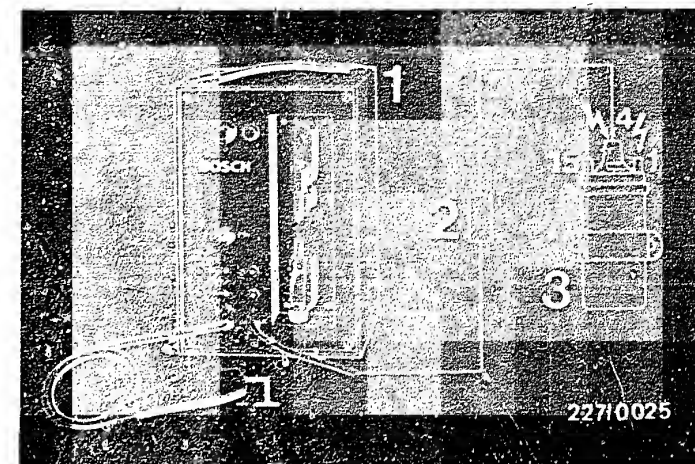
V
Continued on next picture page

Starting motor operates, engine fails to start (continued 2)

* Disconnect ignition cable term. 4 from distributor cap and connect to vehicle ground with spark gap.
(Caution! Engine must not start).

Caution:

When using a spark gap, it is necessary - in order to prevent irreparable damage to the trigger box - to connect an interference-suppression resistor of at least 2 k Ω between spark gap and ignition coil term. 4., e.g. sleeve-type suppressor (5 k Ω) 0 356 500 001.



- 1 = Spark gap
 - 2 = 5 k Ω sleeve-type suppressor
 - 3 = Ignition coil
- (Caution: term. 1 and term. 4: Dangerous voltages 400 V - 25 kV).

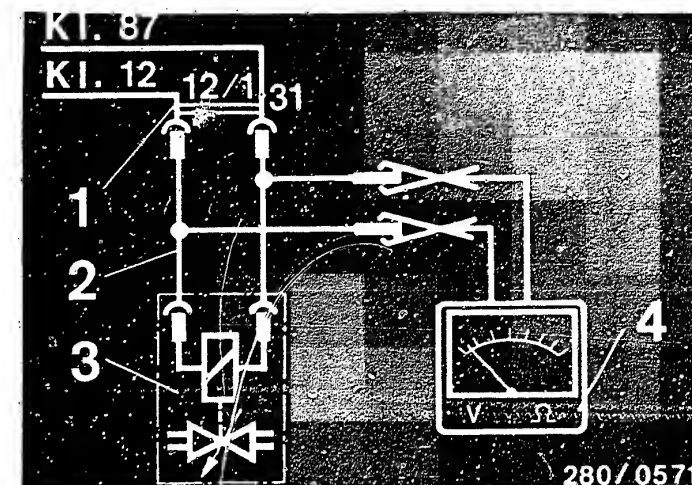
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- * Connect 2-pole adapter lead 1 684 463 093 between an injection valve and its electrical connecting lead.
- * Connect multimeter to free measuring poles. Measuring range approx. 10 V.
- * Disconnect plug from temperature sensor II (engine) (blue plug).

MEASURING:

- * Start engine.
- * Voltage reading drops from initially approx. 7 V within approx. 15 s cranking time to approx. 0.5 V.
If voltages not obtained → replace control unit.
- * Wait more than one minute before repeating.
- * Connect plug to temperature sensor. If engine at operating temperature, start → voltage reading less than 0.5 V.



- 1 = Valve lead connector
- 2 = Adapter lead 1 684 463 098
- 3 = Injection valve
- 4 = Multimeter

Term. 87 = from control relay
Term. 12 = from control unit

Arrow=Temperature sensor II (engine) on engine block at rear right



Continued on next picture page

Starting motor operates, engine fails to start (continued 4)

Auxiliary-air device mechanically O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose pinched off

N>

Check auxiliary-air device

* Visual examination

Disconnect hoses and look down, possibly using a small mirror. When cold, the cross section must be partially open; with the engine warm, it must be closed. If not, replace auxiliary-air device.

* Functional test

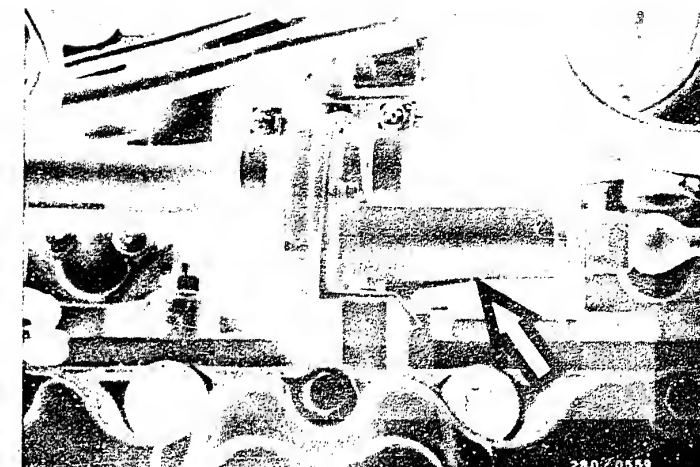
With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If incorrect, replace auxiliary-air device (paying attention to direction of flow).

Electrical operation of auxiliary-air device (power supply, ground lead, resistance) O.K.?

N>

Start engine.

- * Voltage at plug min. 12 V.
If not, check the following leads for continuity (specification approx 0 Ω):
 - * From term. 26 to central ground
 - * From term. 9/2 to control-unit plug term. 9.
- * Resistance of auxiliary-air device 30...65 Ω (plug disconnected). If resistance not within tolerance, replace auxiliary-air device.



Arrow = Auxiliary-air device

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

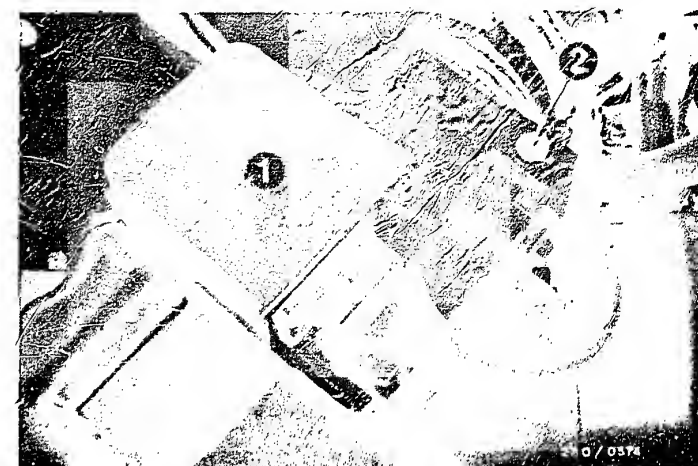
Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

Testing:

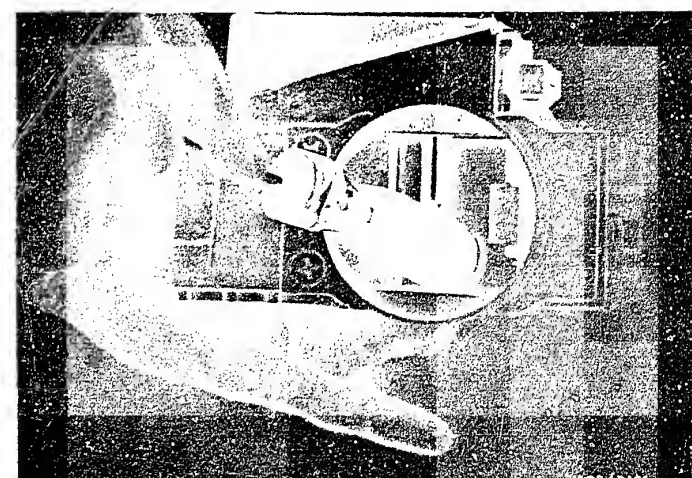
- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

CAUTION !
After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Continued on next picture page

Starting motor operates, engine fails to start (continued 6)

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

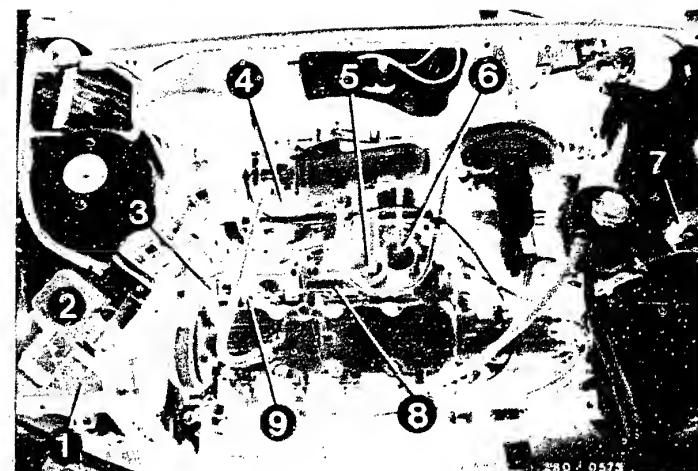
* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air filter housing and seal off air-flow sensor duct. Disconnect hose after auxiliary-air device and blow air (0.3 bar gauge pressure) into the intake manifold with a compressed-air gun. Seal off connection port on auxiliary-air device. Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine: Oil dipstick not securely inserted, defective cap seal on oil filler neck etc. Bubbling or foaming indicates a leak.



- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Temperature sensor II
- 4 = Throttle-valve switch
- 5 = Injection valves
- 6 = Pressure regulator
- 7 = Control relay
- 8 = Auxiliary-air device
- 9 = Central ground

Continued on next picture page



Trouble-shooting program
completed for customer complaint

"Starting motor operates,
engine fails to start or
starts only with great
difficulty"

If the fault has not been found or if
further information is required on
how to remedy the fault, continue
with the trouble-shooting chart of
your choice.

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.

ENGINE STARTS BUT THEN DIES

Trouble-shooting program according to customer complaints

Procedure

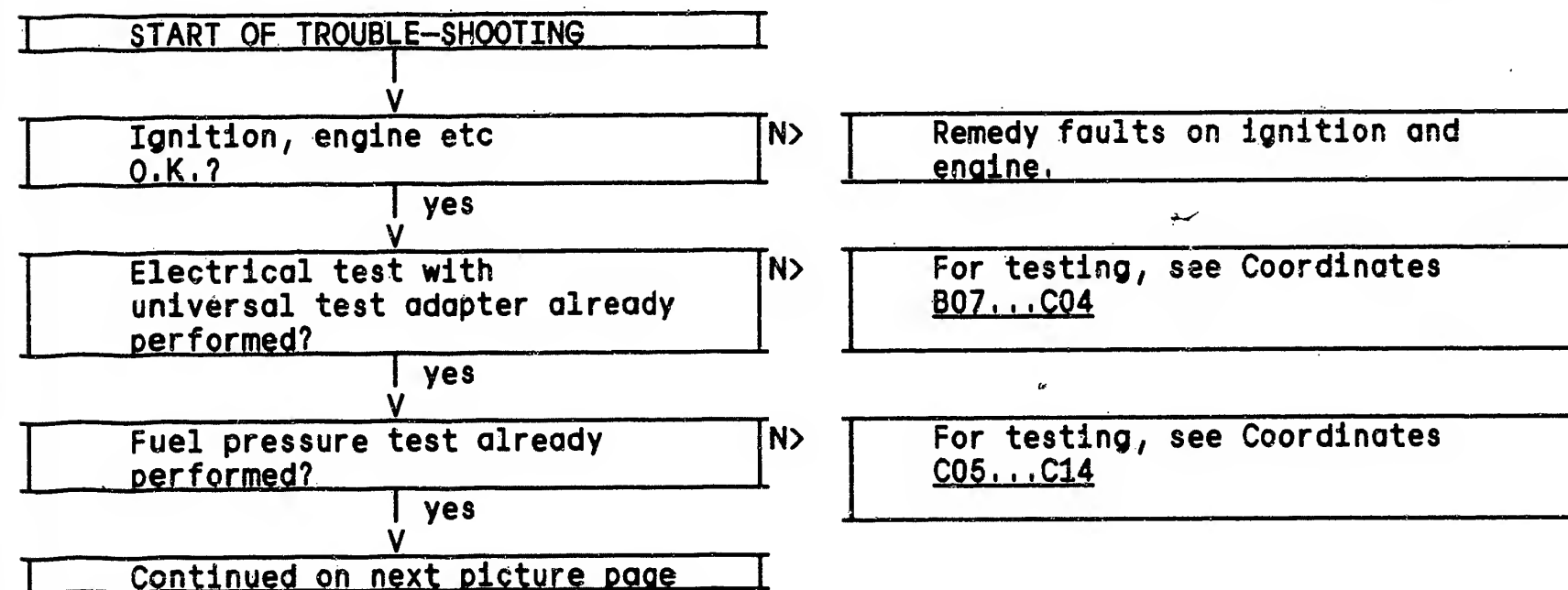
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Engine starts but then dies (continued 1)

Auxiliary-air device mechanically
O.K.?

Free cross section:

- * cold — open?
- * warm — closed?
- * Drop in engine speed when hose
pinched off

N>

Check auxiliary-air device

* Visual examination

Disconnect hoses and look down,
possibly using a small mirror.
When cold, the cross section
must be partially open; with
the engine warm, it must be
closed. If not, replace
auxiliary-air device.

* Functional test

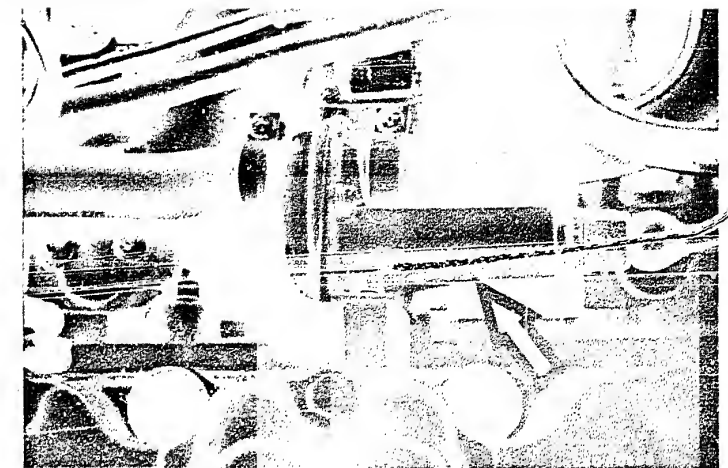
With the engine cold, pinch off
hose to auxiliary-air device.
Engine speed must drop.
With the engine warm, pinch off
hose to auxiliary-air
device. There must be no
noticeable drop in engine
speed. If incorrect, replace
auxiliary-air device (paying
attention to direction of
flow).

Electrical operation of auxiliary-
air device (power supply, ground
lead, resistance)
O.K.?

N>

Start engine.

- * Voltage at plug min. 12 V.
If not, check the following
leads for continuity
(specification approx 0 Ω)
- * From term. 26 to central
ground.
- * Front term. 9/2 to control-unit
plug term. 9.
- * Resistance of auxiliary-air
device 30 ... 65 Ω (plug
disconnected). If resistance
not within tolerance, replace
auxiliary-air device.



Arrow = Auxiliary-air device

Continued on next picture page

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

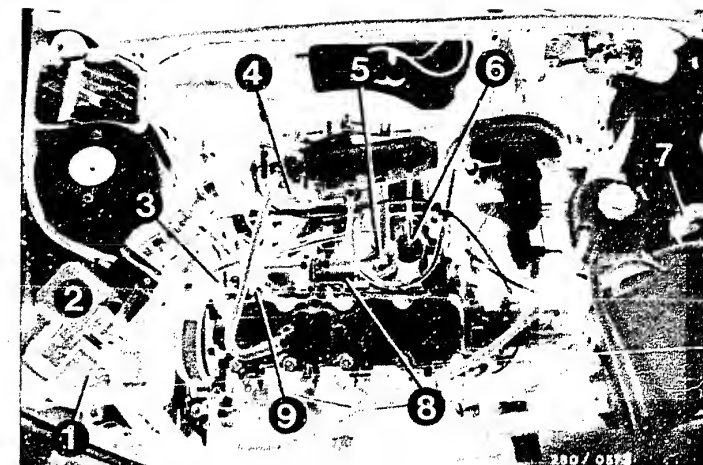
* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air filter housing and seal off air-flow sensor duct. Disconnect hose after auxiliary-air device and blow air (0.3 bar gauge pressure) into the intake manifold with a compressed-air gun. Seal off connection port on auxiliary-air device. Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine: Oil dipstick not securely inserted, defective cap seal on oil filler neck etc. Bubbling or foaming indicates a leak.



- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Temperature sensor II
- 4 = Throttle-valve switch
- 5 = Injection valves
- 6 = Pressure regulator
- 7 = Control relay
- 8 = Auxiliary-air device
- 9 = Central ground

Continued on next picture page



Trouble-shooting program
completed for customer complaint

"Engine starts but then dies"

If the fault has not been found or
if further information is required
on how to remedy the fault, continue
with the trouble-shooting chart of
your choice.

Detailed trouble-shooting chart
Coordinates B3...B4

Direct trouble-shooting chart
Coordinates B3...B8

ROUGH IDLE, INCORRECT IDLE SPEED

Trouble-shooting program according to customer complaints

Procedure

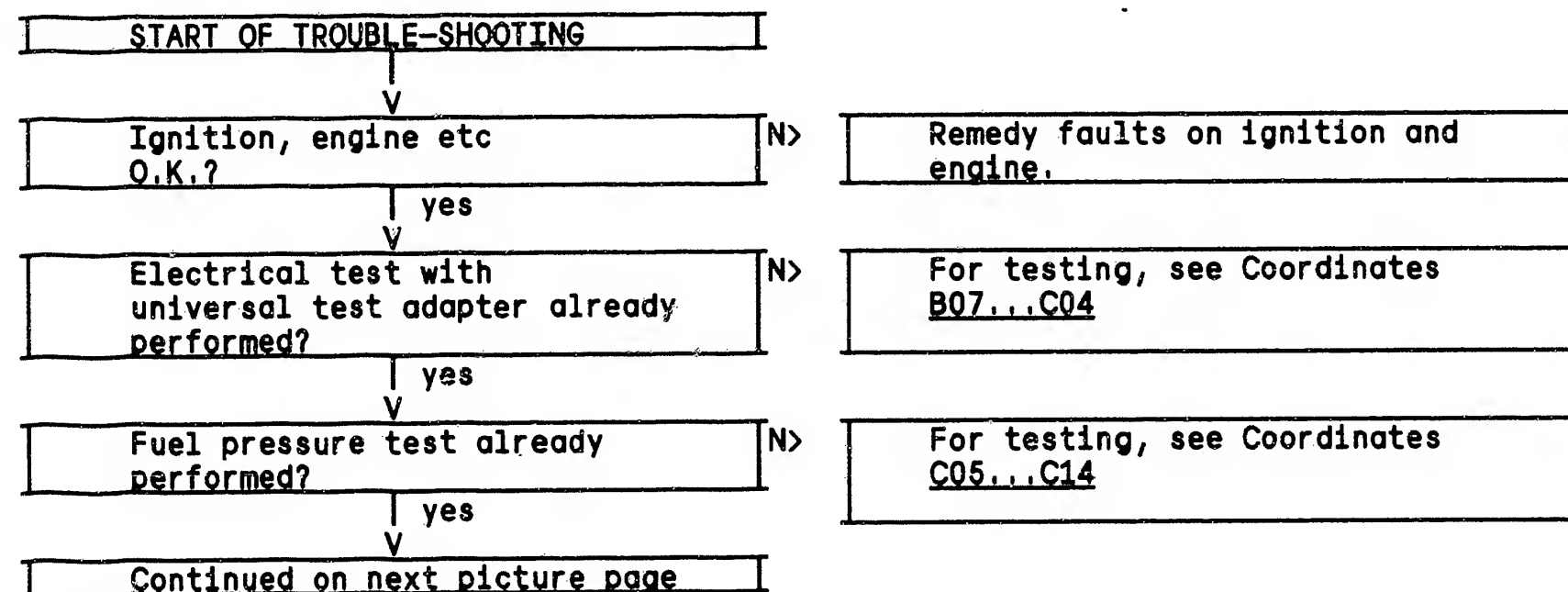
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Rough idle, incorrect idle speed (continued 1)

Throttle valve closed?
Engine coughing on overrun?

- * Throttle lever coming up against stop screw?
- * Throttle cable free of tension?
- * Throttle cable without kinks?

N>

* Testing:

Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

* Adjusting the throttle valve:

The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

- * If throttle cable kinked - replace.

Throttle-valve switch correctly adjusted?

- * Idle contact closing?
- * Microswitch clicking audibly?

N>

* Adjusting

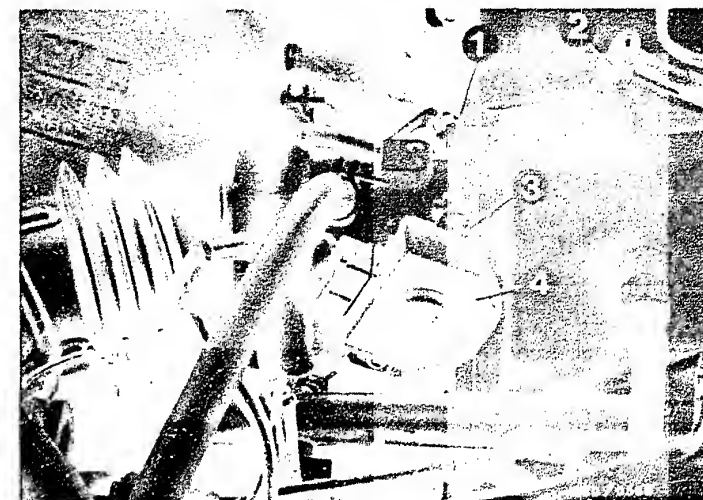
Slightly loosen fastening screws. Connect ohmmeter to throttle-valve switch between term. 2 and term. 9/18.

Turn throttle-valve switch in a counterclockwise direction until idle contact closes (microswitch clicks audibly).

Reading: 0 Ω .

* Checking the adjustment:

Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading infinity Ω



1 = Throttle-valve stop screw

2 = Throttle lever

3 = Fastening screws

4 = Throttle-valve switch

Continued on next picture page

Rough idle, incorrect idle speed (continued 2)

Idle speed and CO correctly adjusted?

N>

Idle speed not adjustable.

* Idle speed and CO adjustment

Exhaust-gas adjustment with exhaust-gas analyzer with engine at normal operating temperature and at idle speed.

* Idle speed

Manual transmission:

Europe: 850...900 min ⁻¹

Sweden/

Switzerland: 900...950 min ⁻¹

5-speed

(Europe): 900...950 min ⁻¹

Automatic: 800...850 min ⁻¹

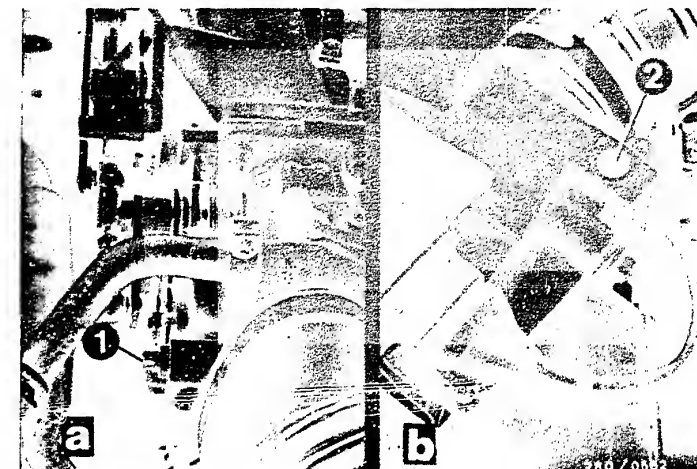
* CO concentration

Europe: 0,5...1,5 vol% CO

Sweden/

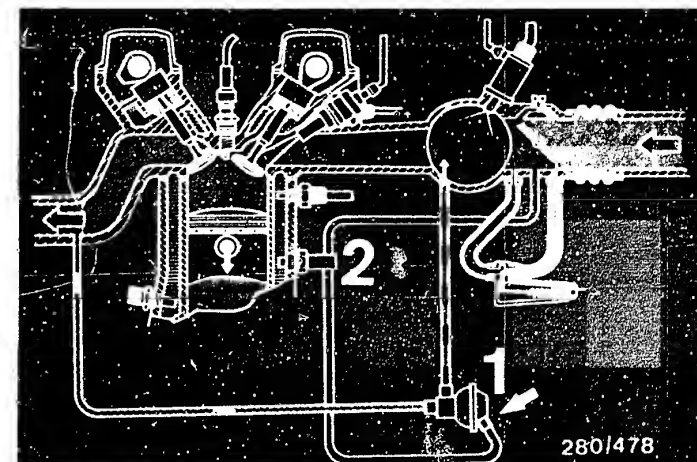
Switzerland: max. 0,3 vol% CO

* Due to certain exhaust emission legislation the vehicles of the Sweden/ Switzerland version are equipped with exhaust-gas recirculation (EGR). When checking/adjusting the idle and CO, disconnect and seal the vacuum control line (arrow) on the EGR valve in order to guarantee that the EGR system is inoperative. It is not necessary to shut down the EGR system when running the vehicle in countries where such stringent regulations do not apply.



1 = Idle-speed adjusting screw
2 = CO adjusting scrow

1 = EGR valve
2 = Thermo-valve

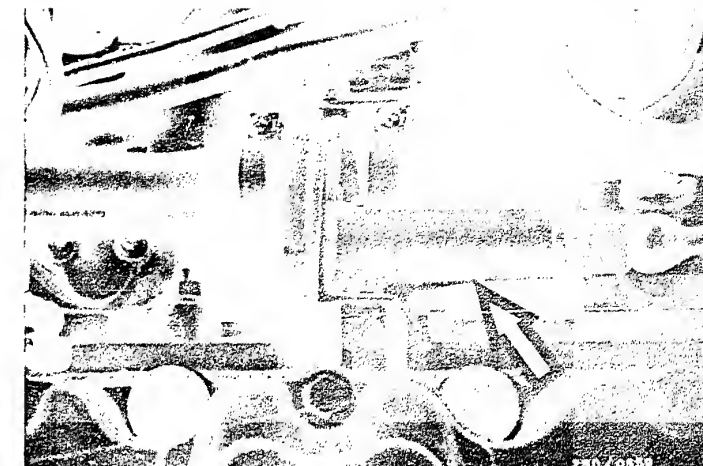


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For all vehicles:

If CO concentration too high, turn CO adjusting screw in air-flow sensor half a turn in a counterclockwise direction (hexagon-socket-head cap screw AF = 5 mm). Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjusting, use new red plug. (1 280 508 012)



Arrow = Auxiliary-air device

Auxiliary-air device mechanically O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose pinched off

N>

Check auxiliary-air device

* Visual examination

Disconnect hoses and look down, possibly using a small mirror. When cold, the cross section must be partially open; with the engine warm, it must be closed. If not, replace auxiliary-air device.

* Functional test

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If incorrect, replace auxiliary-air device (paying attention to direction of flow).

Continued on next picture page

Electrical operation of
auxiliary-air device (power
supply, ground lead, resistance)
O.K.?

N>

Start engine.

- * Voltage at plug min. 12 V.
If not, check the following
leads for continuity
(specification approx 0 Ω)
- * From term. 26 to central
ground.
- * Front term. 9/2 to control-unit
plug term. 9.
- * Resistance of auxiliary-air
device 30 ... 65 Ω (plug
disconnected). If resistance
not within tolerance, replace
auxiliary-air device.

Vacuum limiter (Sweden version
only) O.K.?

N>

- * Drop in engine speed when
hose pinched off?
- * Vacuum limiter opening on
overrun?

Testing:

* Let engine idle. Pinch
off connecting hose before
or after vacuum limiter.
If engine speed drops, replace
vacuum limiter.

* If not, disconnect connecting
hose before throttle valve and
seal connection at throttle
valve. Briefly open throttle,
engine speed approx 3500 min⁻¹.
Close throttle and check with
finger on vacuum hose whether
air is being drawn in.
If not, replace vacuum limiter.

Continued on next picture page

Injection valves checked for correct operation?

- * Injection pulse without interference or missing?
- * Leads correctly routed?
- * No loose contacts in plug-in connections?

N>

- * Connect test lead as follows:
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one terminal need be connected to the special input of the motortester.
- * C A U T I O N !
The unused terminal must not come into contact with vehicle ground.
- * If correctly connected, the oscilloscope pattern shown opposite is visible on the oscilloscope. It is possible with the aid of the test lead to check the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if there are deviations (interference, missing), the other injection valves should also be checked.
- * In case of interference:
Check routing of leads.
- * In case of missing:
Eliminate loose contacts in the leads or in the plug-in connections.



Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

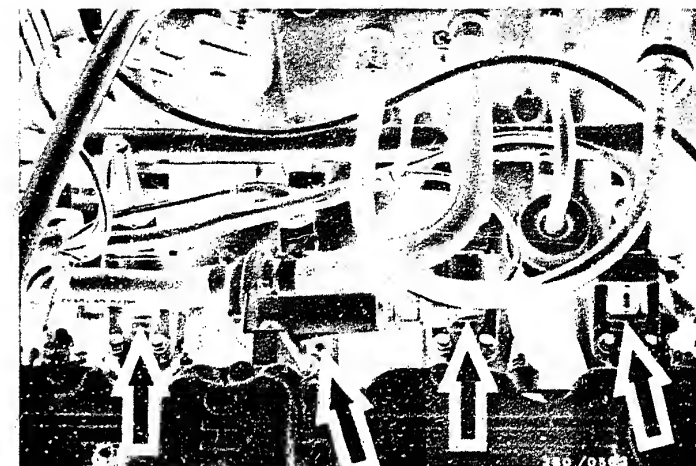
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Injection valve mechanically
O.K.?

* Does engine speed drop when
injection-valve connectors
are pulled off?

N>

* With the engine running,
disconnect injection-valve
connectors individually,
one after the other, from
the injection valves and re-
connect. Engine speed must
drop if injection valve O.K.



Arrows = Injection valves

Continued on next picture page

Air-flow sensor mechanically
and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

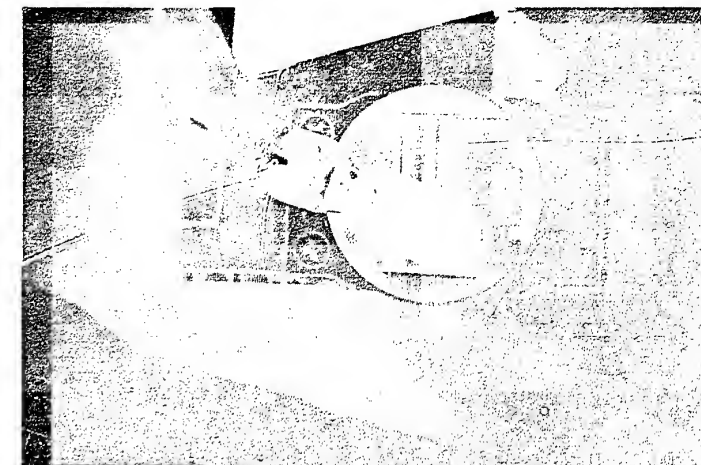
N>

Testing:

- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

CAUTION !

After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



Opening the air-flow sensor flap

Continued on next picture page

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

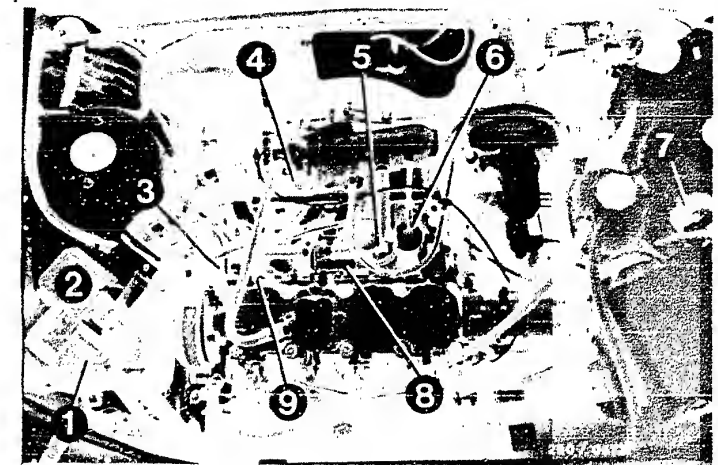
* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air filter housing and seal off air-flow sensor duct. Disconnect hose after auxiliary-air device and blow air (0.3 bar gauge pressure) into the intake manifold with a compressed-air gun. Seal off connection port on auxiliary-air device. Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine: Oil dipstick not securely inserted, defective cap seal on oil filler neck etc. Bubbling or foaming indicates a leak.



- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Temperature sensor II
- 4 = Throttle-valve switch
- 5 = Injection valves
- 6 = Pressure regulator
- 7 = Control relay
- 8 = Auxiliary-air device
- 9 = Central ground

Continued on next picture page

Rough idle, incorrect idle speed (continued 9)

Idle speed and
* CO correctly adjusted?
(Repeat)

N>

* Idle speed and CO adjustment
Exhaust-gas adjustment with
exhaust-gas analyzer with
engine at normal operating
temperature and at idle speed.

* Idle speed

Manual transmission:

Europe: 850...900 min ⁻¹
Sweden/
Switzerland: 900...950 min ⁻¹
5-speed
(Europe): 900...950 min ⁻¹
Automatic: 800...850 min ⁻¹

* CO concentration

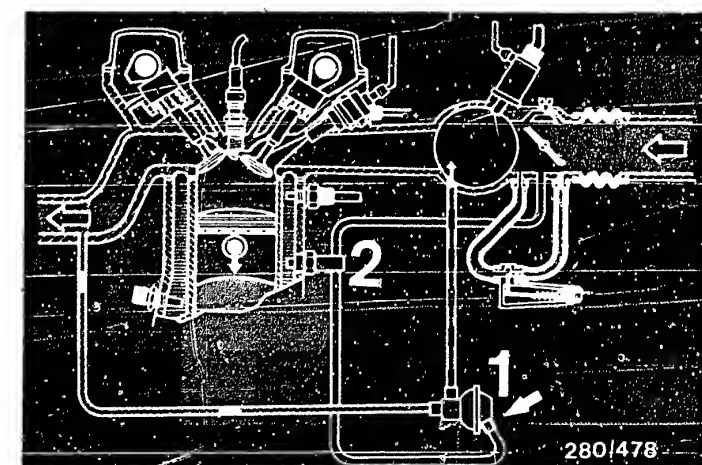
Europe: 0,5...1,5 vol% CO
Sweden/
Switzerland: max. 0,3 vol% CO

* Due to certain exhaust
emission legislation the
vehicles of the Sweden/
Switzerland version are equip-
ped with exhaust-gas re-
circulation (EGR). When
checking/adjusting the idle
and CO, disconnect and seal the
vacuum control line (arrow)
on the EGR valve in order
to guarantee that the EGR
system is inoperative. It is
not necessary to shut down the
EGR system when running the
vehicle in countries where such
stringent regulations do not
apply.



1 = Idle-speed
adjusting screw
2 = CO adjusting scw

1 = EGR valve
2 = Thermo-valve



Continued on next picture page

Continued on next picture page



For all vehicles:

If CO concentration too high,
turn bypass screw (CO
adjusting screw) in air-flow
sensor half a turn in a counter-
clockwise direction (hexagon-
socket-head cap screw
AF = 5 mm).
Check idle speed and CO con-
centration again.
If necessary, make corrections
in several steps. After
adjusting, use new (red) plugs
(1 280 508 012).



Trouble-shooting program
completed for customer complaint

"Rough idle, incorrect idle
speed".

If the fault has not been found or
if further information is required
on how to remedy the fault, continue
with the trouble-shooting chart of
your choice.

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.

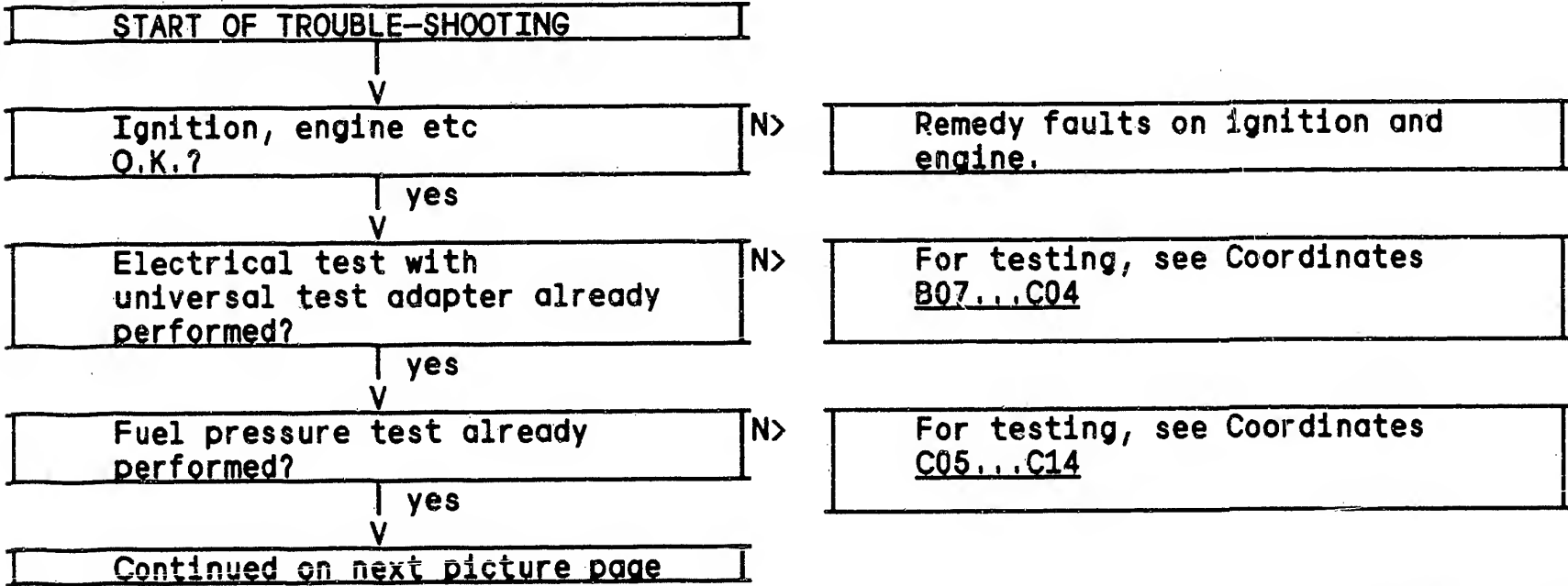
Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.



Poor throttle take-up (continued 1)

Throttle valve closed?
Engine coughing on overrun?

- * Throttle lever coming up against stop screw?
- * Throttle cable free of tension?
- * Throttle cable without kinks?

N>

* Testing:

Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

* Adjusting the throttle valve:

The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

- * If throttle cable kinked - replace.

Throttle-valve switch correctly adjusted?

- * Idle contact closing?
- * Microswitch clicking audibly?

N>

* Adjusting

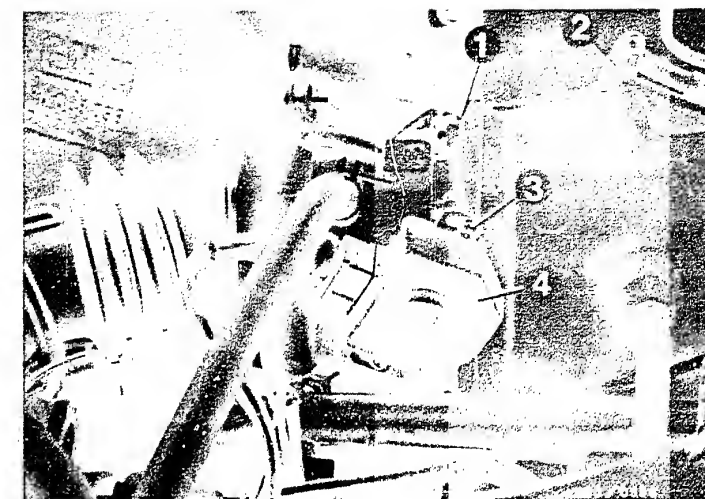
Slightly loosen fastening screws. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18.

Turn throttle-valve switch in a counterclockwise direction until idle contact closes (microswitch clicks audibly).

Reading: 0 Ω .

* Checking the adjustment:

Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading infinity Ω



- 1 = Throttle-valve stop screw
- 2 = Throttle lever
- 3 = Fastening screws
- 4 = Throttle-valve switch

Continued on next picture page

Auxiliary-air device mechanically O.K.?

Free cross section:

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose pinched off

N>

Check auxiliary-air device

* Visual examination

Disconnect hoses and look down, possibly using a small mirror. When cold, the cross section must be partially open; with the engine warm, it must be closed. If not, replace auxiliary-air device.

* Functional test

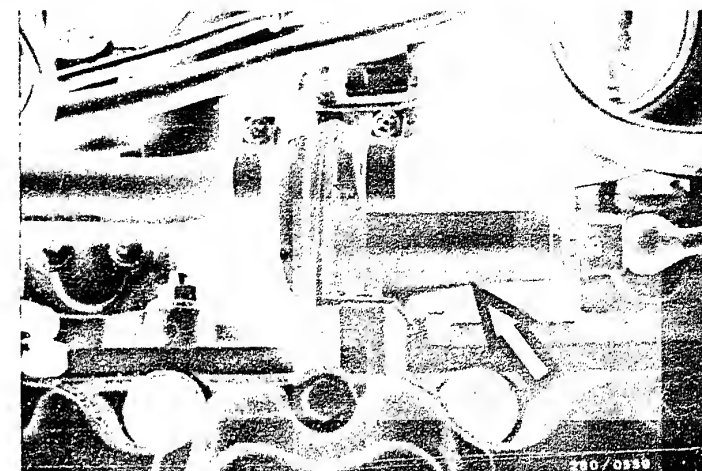
With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If incorrect, replace auxiliary-air device (paying attention to direction of flow).

Electrical operation of auxiliary-air device (power supply, ground lead, resistance) O.K.?

N>

Start engine.

- * Voltage at plug min. 12 V.
If not, check the following leads for continuity (specification approx 0 Ω):
- * From term. 26 to central ground
- * From term. 9/2 to control-unit plug term. 9.
- * Resistance of auxiliary-air device 30...65 Ω (plug disconnected). If resistance not within tolerance, replace auxiliary-air device.



Arrow = Auxiliary-air device

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

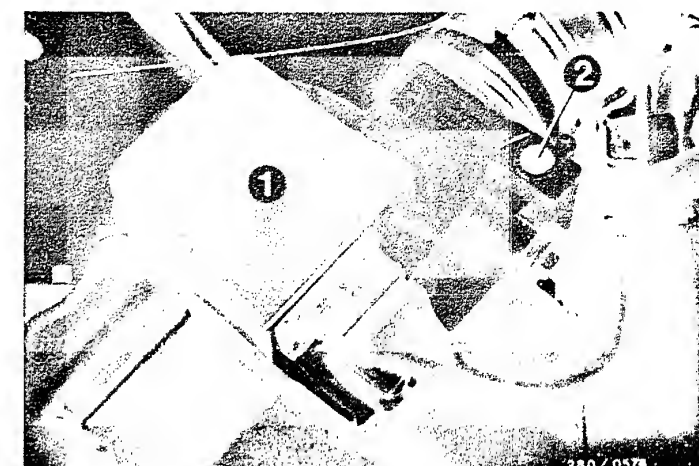
N>

Testing:

- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

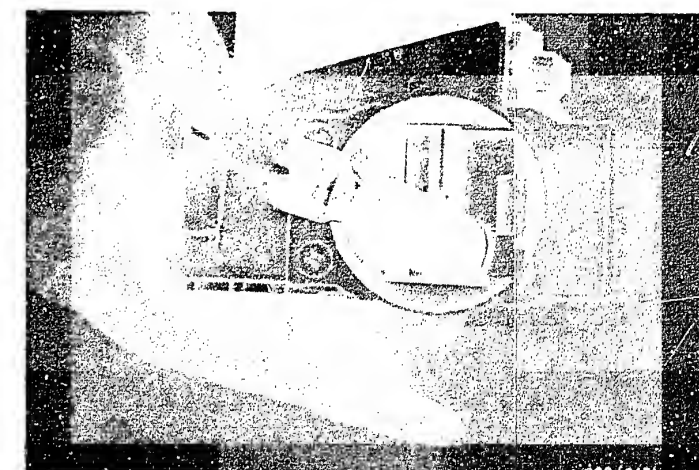
CAUTION !

After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Continued on next picture page

Air-flow sensor potentiometer
O.K.?

* Potentiometer wiper track
O.K.?

* Stroke signal correct?

N>

Potentiometer test:

(Noise test)

* Unscrew air-flow sensor from air-filter housing and loosen hose clamp. Leave plug on. Set motor-tester to special input and, using the special cable, connect to air-flow sensor term. 7 (red clip) and term. 5 (black clip).

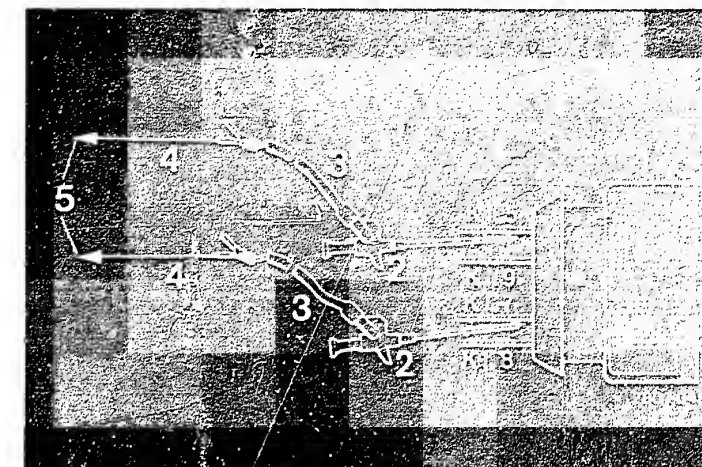
* Make adapter lead:

Two approx. 1 m long leads of approx 1.0 mm² cross section and 10 A fuse. At one end attach. At the other end, strip off approx. 2 cm of insulation and connect with the clamps of the special-input connecting lead.

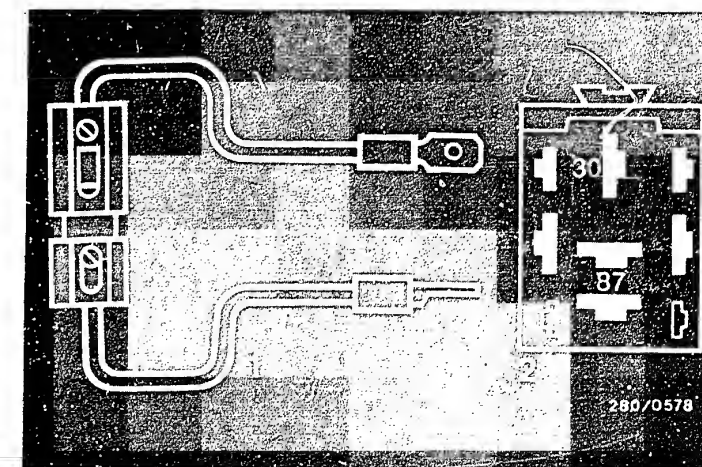
C A U T I O N

Insulate bare connecting points of adapter lead (danger of short circuit). Measure carefully into the plug of the air-flow sensor. Do not bend any plug-in springs. Set control lever for image adjustment on motortester as far as it will go to the left (calibrated setting).

* Disconnect control relay. Connect jumper into connection base between term. 87 and term. 30. (Power supply through the control unit)



- 1 = Air-flow sensor plug
- 2 = Test prod
- 3 = Adapter lead (User-fabricated)
- 4 = Special input connecting lead
- 5 = Motortester special input
- 1 = Jumper with fuse holder and 10 A fuse
- 2 = Top view of connection base



Continued on next picture page

Continued on next picture page

V

* Deflect air-flow sensor flap suddenly several times.

If air-flow sensor O.K., a continuous stroke signal must be visible on the oscilloscope.

If air-flow sensor defective, there is a noise signal similar to the one shown opposite.

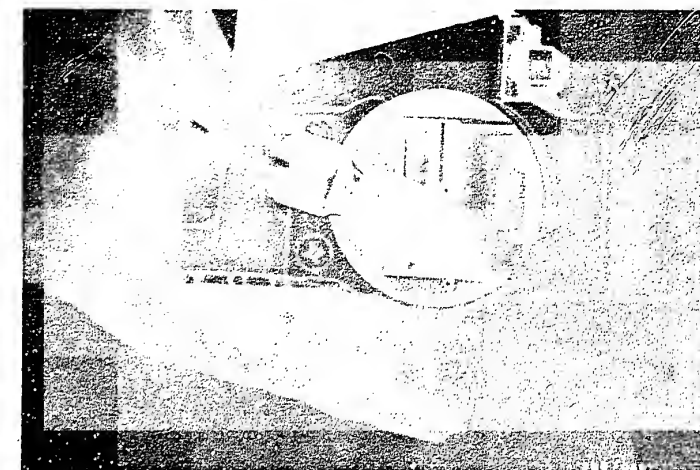
Replace air-flow sensor.

Disconnect adapter lead after testing and put on rubber sleeve correctly.

Mount air-flow sensor.

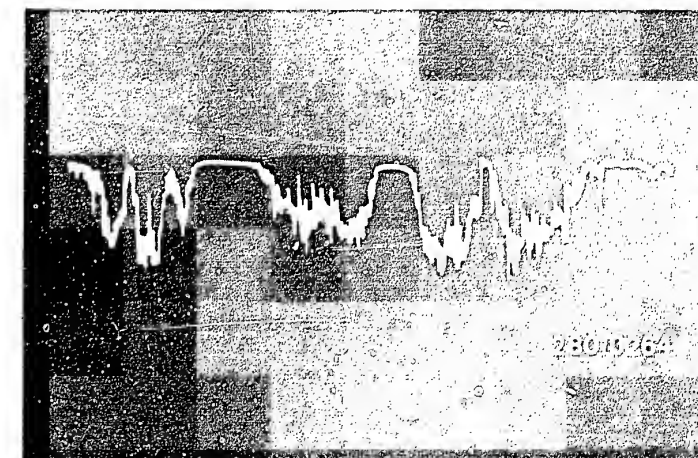
Connect all hoses and tighten (no leaks).

C A U T I O N :
After testing, remove the jumper and re-connect the control relay.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



V

Continued on next picture page

Are all hose lines correctly connected, not kinked or damaged?

Visual examination.

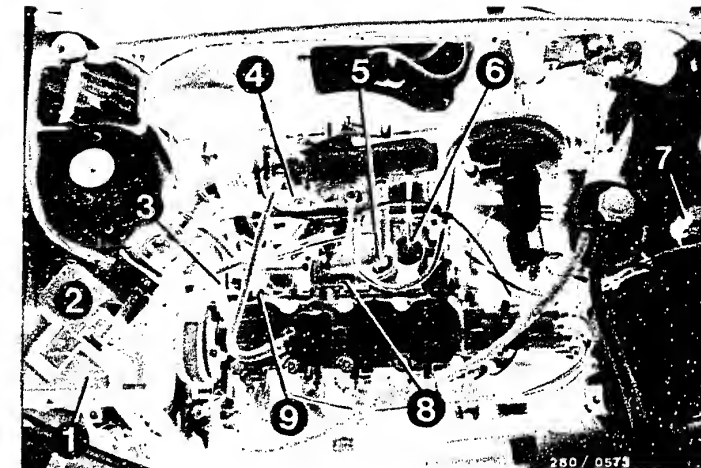
* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air filter housing and seal off air-flow sensor duct. Disconnect hose after auxiliary-air device and blow air (0.3 bar gauge pressure) into the intake manifold with a compressed-air gun. Seal off connection port on auxiliary-air device. Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine: Oil dipstick not securely inserted, defective cap seal on oil filler neck etc. Bubbling or foaming indicates a leak.



- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Temperature sensor II
- 4 = Throttle-valve switch
- 5 = Injection valves
- 6 = Pressure regulator
- 7 = Control relay
- 8 = Auxiliary-air device
- 9 = Central ground

Continued on next picture page

Poor throttle take-up (continued 7)

Idle speed and CO correctly adjusted?

N>

Idle speed not adjustable.

* Idle speed and CO adjustment

Exhaust-gas adjustment with exhaust-gas analyzer with engine at normal operating temperature and at idle speed.

* Idle speed

Manual transmission:

Europe: 850...900 min⁻¹

Sweden/

Switzerland: 900...950 min⁻¹

5-speed

(Europe): 900...950 min⁻¹

Automatic: 800...850 min⁻¹

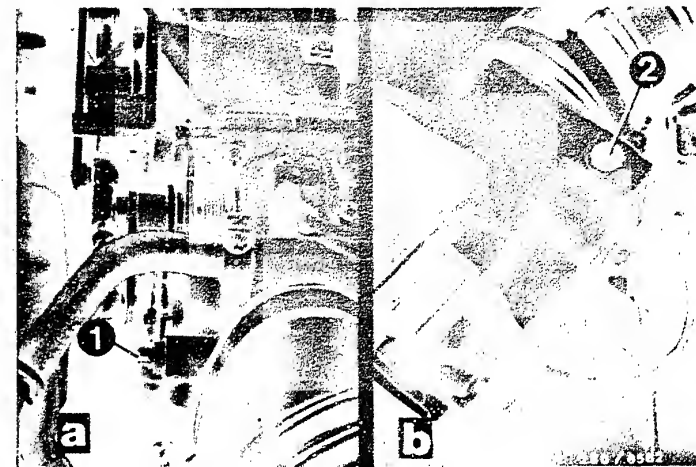
* CO concentration

Europe: 0,5...1,5 vol% CO

Sweden/

Switzerland: max. 0,3 vol% CO

* Due to certain exhaust emission legislation the vehicles of the Sweden/Switzerland version are equipped with exhaust-gas recirculation (EGR). When checking/adjusting the idle and CO, disconnect and seal the vacuum control line (arrow) on the EGR valve in order to guarantee that the EGR system is inoperative. It is not necessary to shut down the EGR system when running the vehicle in countries where such stringent regulations do not apply.

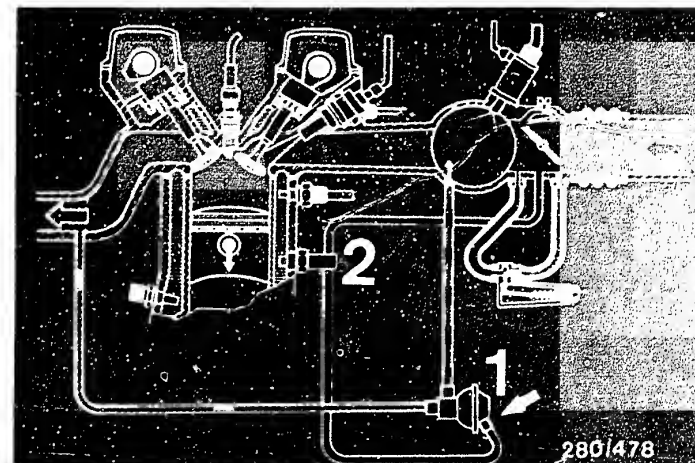


1 = Idle-speed adjusting screw

2 = CO adjusting screw

1 = EGR valve

2 = Thermo-valve



Continued on next picture page

Continued on next picture page

V

For all vehicles:

If CO concentration too high,
turn bypass screw (CO
adjusting screw) in air-flow
sensor half a turn in a counter-
clockwise direction (hexagon-
socket-head cap screw
AF = 5 mm).
Check idle speed and CO con-
centration again.
If necessary, make corrections
in several steps. After
adjusting, use new (red) plugs
(1 280 508 012).

V

Trouble-shooting program
completed for customer complaint

Poor throttle take-up"

N>

If the fault has not been found
or if further information is
required on how to remedy the fault,
continue with the trouble-shooting
chart of your choice.

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.

ENGINE MISSING UNDER ALL OPERATING CONDITIONS

Trouble-shooting program according to customer complaints

Procedure

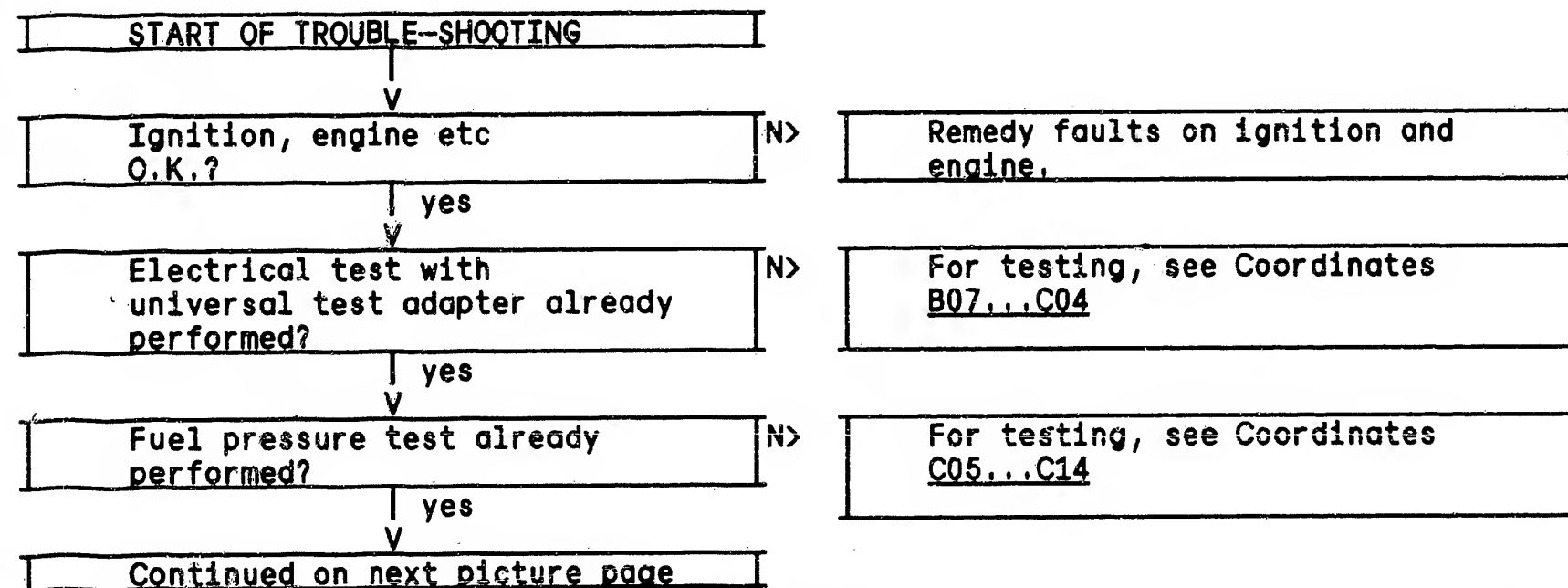
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



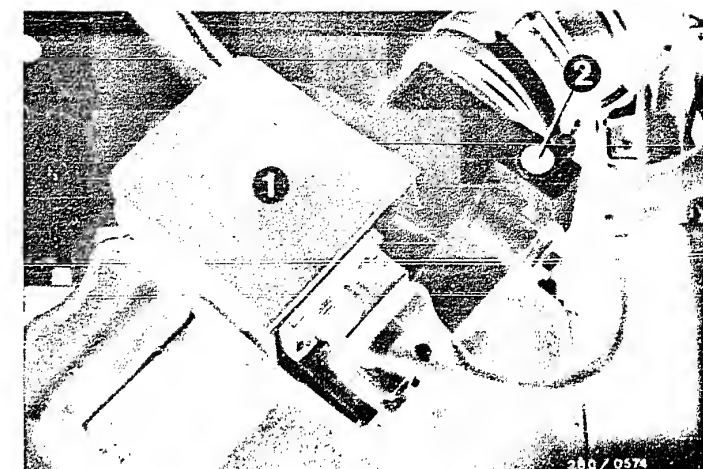
Engine missing under all operating conditions (continued 1)

Alternator with regulator
O.K.?

N>

* Engine not missing due to
voltage spikes?

* With engine off, disconnect
plug from alternator. Start
engine. If missing stops,
check alternator and regulator.
Voltage spikes are visible on
the ignition oscilloscope.



1 = Air-flow sensor
2 = CO adjusting screw

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

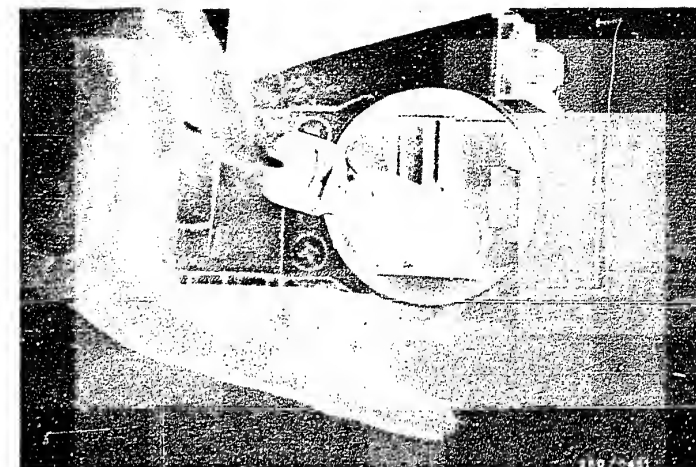
N>

Testing:

- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term.8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

CAUTION !

After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



Opening the air-flow sensor flap

Continued on next picture page

Air-flow sensor potentiometer
O.K.?

* Potentiometer wiper track
O.K.?

* Stroke signal correct?

N>

Potentiometer test:

(Noise test)

* Unscrew air-flow sensor from air-filter housing and loosen hose clamp. Leave plug on. Set motor-tester to special input and, using the special cable, connect to air-flow sensor term. 7 (red clip) and term. 5 (black clip).

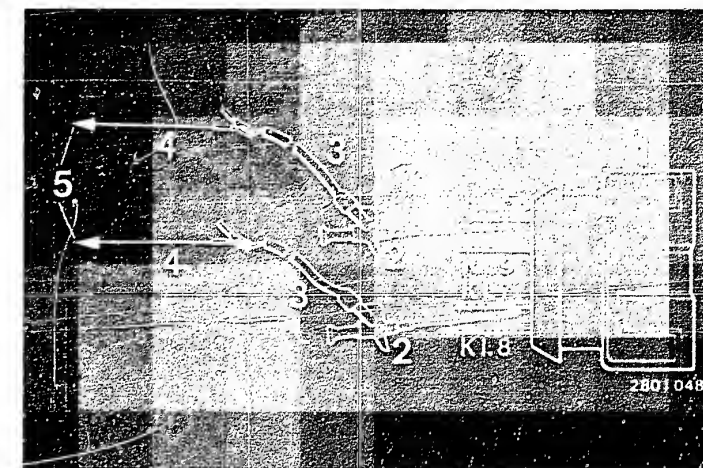
* Make adapter lead:

Two approx. 1 m long leads of approx 1.0 mm ² cross section and 10 A fuse. At one end attach. At the other end, strip off approx. 2 cm of insulation and connect with the clamps of the special-input connecting lead.

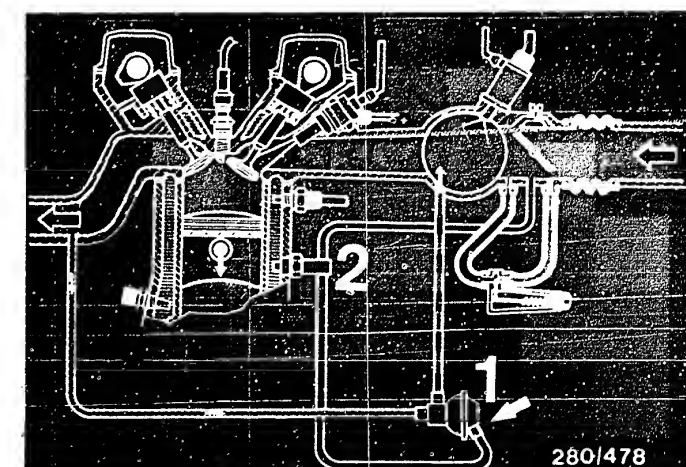
C A U T I O N

Insulate bare connecting points of adapter lead (danger of short circuit). Measure carefully into the plug of the air-flow sensor. Do not bend any plug-in springs. Set control lever for image adjustment on motortester as far as it will go to the left (calibrated setting).

* Disconnect control relay. Connect jumper into connection base between term. 87 and term. 30. (Power supply through the control unit)



- 1 = Air-flow sensor plug
- 2 = Test prod
- 3 = Adapter lead (User-fabricated)
- 4 = Special input connecting lead
- 5 = Motortester special input
- 1 = Jumper with fuse holder and 10 A fuse
- 2 = Top view of connection base



Continued on next picture page

Continued on next picture page

* Deflect air-flow sensor flap suddenly several times.

If air-flow sensor O.K., a continuous stroke signal must be visible on the oscilloscope.

If air-flow sensor defective, there is a noise signal similar to the one shown opposite.

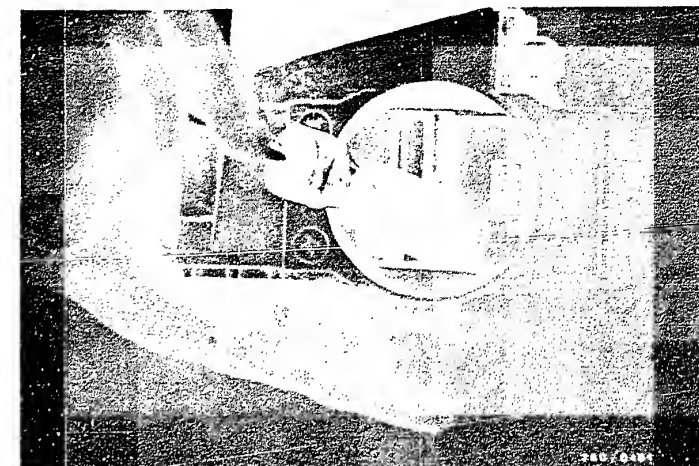
Replace air-flow sensor.

Disconnect adapter lead after testing and put on rubber sleeve correctly.

Mount air-flow sensor.

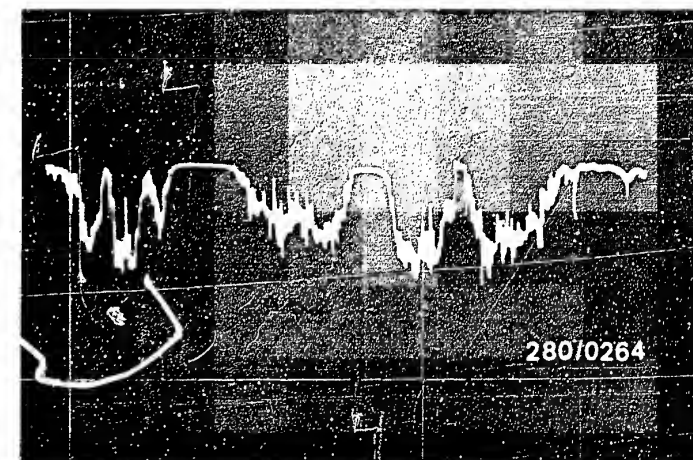
Connect all hoses and tighten (no leaks).

C A U T I O N :
After testing, remove the jumper and re-connect the control relay.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



Continued on next picture page

Engine missing under all operating conditions (continued 5)

Delivery of electric fuel
pump O.K.?

Test specification: min.
700 cm³ /30 s

N>

* Measuring the fuel delivery:

For testing, undo junction between fuel return hose (from pressure regulator) and fuel return line (to fuel tank). If necessary, extend hose and lead into a 5l vessel with graduated scale. Disconnect control relay. Connect jumper into connection base between term. 87b and term. 30. Electric fuel pump must operate.

Test specification:

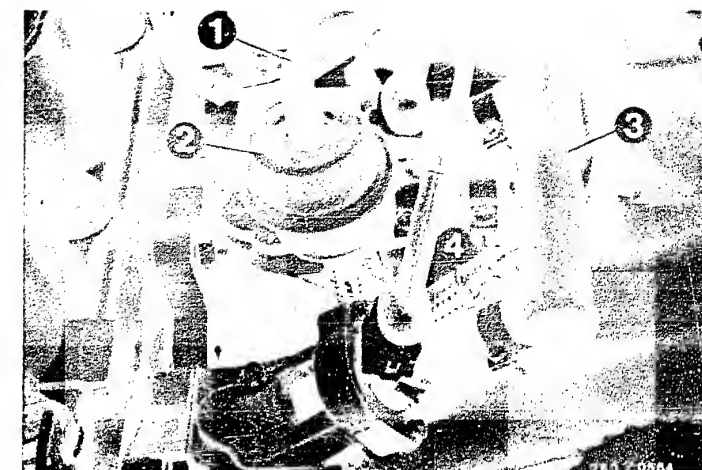
min. 700 cm³ /30s

Caution: After testing is completed, be sure to remove the jumper.

Remedy if test specification not obtained:

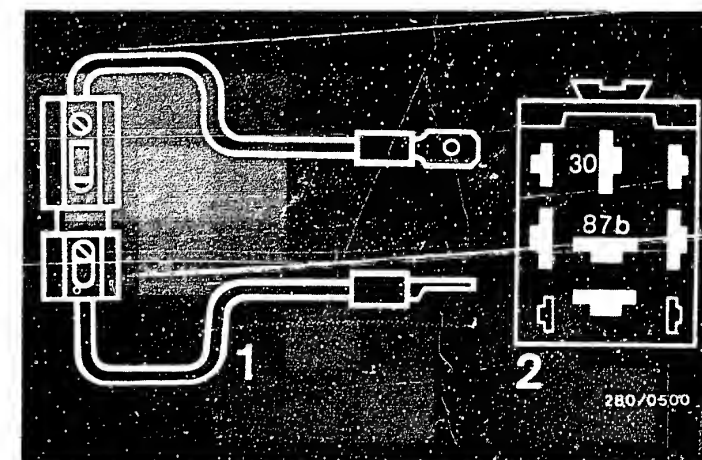
- * Fuel filter clogged - replace.
- * Voltage at the terminals of the electric fuel pump with engine running: min. 12 V. If not, clean contacts; possibly eliminate poor ground connection; replace leads.

- * Fuel pressure regulator defective - replace.
- * If delivery too low, replace electric fuel pump.



- 1 = Intake manifold connection
- 2 = Pressure regulator
- 3 = Fuel-distribution pipe (fuel delivery line)
- 4 = Fuel return line

- 1 = Jumper with fuse holder and 10 A fuse
- 2 = Top view of connection base



Continued on next picture page

Engine missing under all operating conditions (continued 6)

Control unit O.K.?

- * Engine running without missing?
- * Plug-in connections at multiple plug O.K.?

N>

Let engine run.

- * Shake control unit lightly and move control-unit plug. Watch for engine missing.
- * Repair plug-in connection on control-unit plug or replace defective control unit.

Engine coughing on overrun?

- * Exhaust system leak-tight?

N>

- * Check exhaust system for leaks.

Throttle valve closed?

Engine coughing on overrun?

- * Throttle lever coming up against stop screw?
- * Throttle cable free of tension?
- * Throttle cable without kinks?

N>

* Testing:

Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

* Adjusting the throttle valve:

The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

- * If throttle cable kinked - replace.

Continued on next picture page

Engine missing under all operating conditions (continued 7)

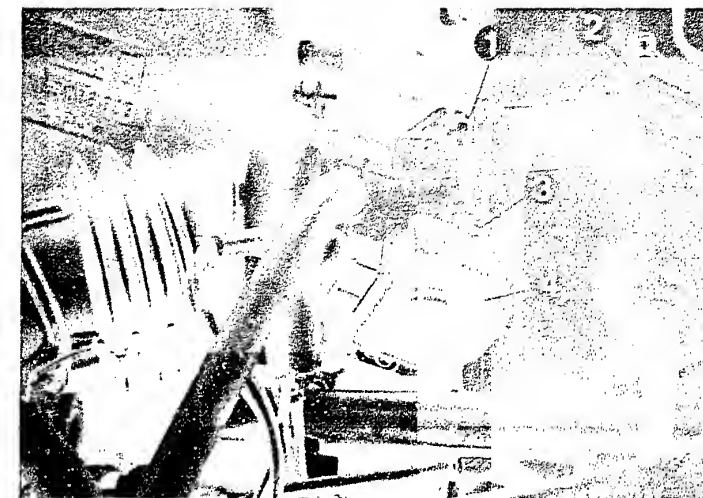
Throttle-valve switch correctly adjusted?

- * Idle contact closing?
- * Microswitch clicking audibly?

N>

* Adjusting
Slightly loosen fastening screws. Connect ohmmeter to throttle-valve switch between term. 2 and term. 9/18.
Turn throttle-valve switch in a counterclockwise direction until idle contact closes (microswitch clicks audibly).
Reading: 0 Ω .

* Checking the adjustment:
Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading infinity Ω .



- 1 = Throttle-valve stop screw
- 2 = Throttle lever
- 3 = Fastening screws
- 4 = Throttle-valve switch

Continued on next picture page

Engine missing under all operating conditions (continued 8)

Engine coughing on overrun?
Overrun cutoff O.K.?

* Operation of control unit
O.K.?

* Reinstatement speed
O.K.?

cold: 2400 min ⁻¹
warm: 1650 min ⁻¹

N>

* Checking the operation of
the overrun cutoff:

Connect test lead as
follows:

The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one terminal need be connected to the special input of the motortester. If correctly connected, the pattern shown opposite is visible on the oscilloscope. Watch oscilloscope.

* Slowly raise engine speed to 2000 min ⁻¹.

Injection pulses must be visible on the oscilloscope. Take foot off accelerator (idle position). No more injection pulses.

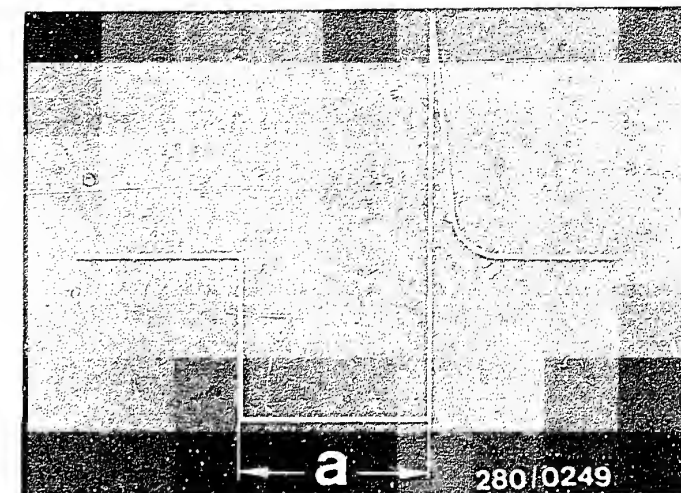
* Engine clearly below
ambient temperature
(+15° C., +30° C):

As of approx. 1250 min ⁻¹
injection pulses must be visible again.

* Engine at operating
temperature (approx. +80° C):

As of approx. min ⁻¹
injection pulses must be visible again.

If incorrect, replace control unit.



Injection pulses of a
switched output stage
(measured at the injection
valve)

a = Pulse length (dependent
on engine load)

Continued on next picture page

V

Vacuum limiter (Sweden
version only) O.K.?

- * Drop in engine speed when
hose pinched off?
- * Vacuum limiter opening on
overrun?

N>

Y

Testing:

- * Let engine idle.
Pinch off connecting hose
before or after vacuum
limiter.
If engine speed drops, re-
place vacuum limiter.
- * If not, disconnect con-
necting hose before
throttle valve and seal
off connection at throttle
valve.
Briefly open throttle, engine
speed approx 3500 min⁻¹.
Close throttle and check
with finger on vacuum hose
whether air is being
drawn in.
If not, replace vacuum
limiter.

Continued on next picture page

Engine missing under all operating conditions (continued 10)

Idle speed and CO correctly
adjusted?

N>

Idle speed not adjustable.

* Idle speed and CO adjustment
Exhaust-gas adjustment with
exhaust-gas analyzer with
engine at normal operating
temperature and at idle speed.

* Idle speed

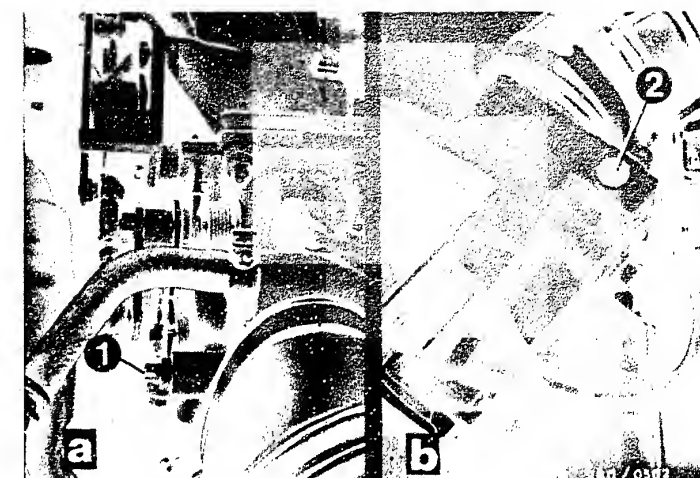
Manual transmission:

Europe: 850...900 min -1
Sweden/
Switzerland: 900...950 min -1
5-speed
(Europe): 900...950 min -1
Automatic: 800...950 min -1

* CO concentration

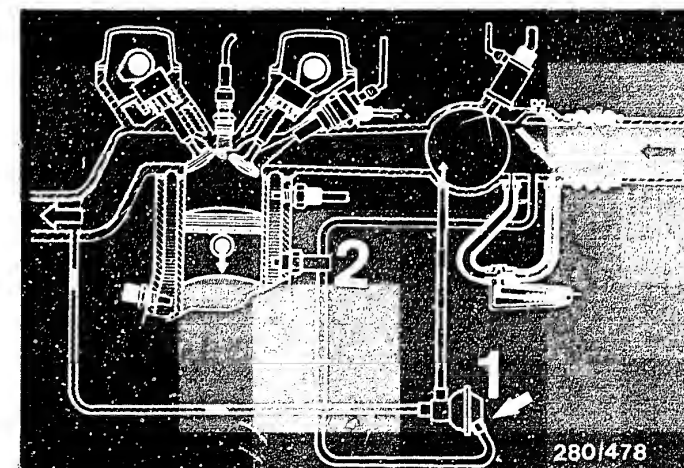
Europe: 0,5...1,5 vol% CO
Sweden/
Switzerland: max. 0,3 vol% CO

* Due to certain exhaust
emission legislation the
vehicles of the Sweden/
Switzerland version are equip-
ped with exhaust-gas re-
circulation (EGR). When
checking/adjusting the idle
and CO, disconnect and seal the
vacuum control line (arrow)
on the EGR valve in order
to guarantee that the EGR
system is inoperative. It is
not necessary to shut down the
EGR system when running the
vehicle in countries where such
stringent regulations do not
apply.



1 = Idle-speed
adjusting screw
2 = CO adjusting scrow

1 = EGR valve
2 = Thermo-valve



Continued on next picture page

Continued on next picture page

Engine missing under all operating conditions (continued 11)

V

For all vehicles:

If CO concentration too high,
turn bypass screw (CO
adjusting screw) in air-flow
sensor half a turn in a counter-
clockwise direction (hexagon-
socket-head cap screw
AF = 5 mm).

Check idle speed and CO con-
centration again.

If necessary, make corrections
in several steps. After
adjusting, use new (red) plugs
(1 280 508 012).

V

Continued on next picture page

Injection valves checked for correct operation?

- * Injection pulse without interference or missing?
- * Leads correctly routed?
- * No loose contacts in plug-in connections?

N>

* Connect test lead as follows: The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one terminal need be connected to the special input of the motortester.

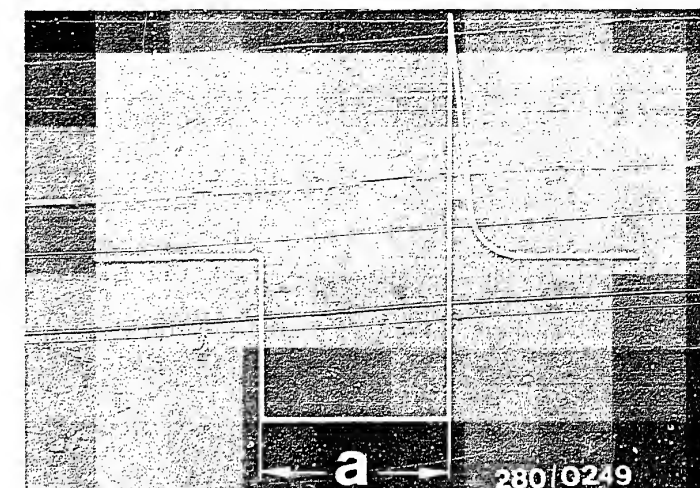
C A U T I O N

Unused terminal must not come into contact with vehicle body.

* If correctly connected, the pattern shown opposite is visible on the oscilloscope. With the aid of the test lead it is possible to check the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if there are deviations (interference, missing etc), the other injection valves should also be checked.

* In case of interference: Check routing of leads.

* In case of missing: Eliminate loose contacts in leads or in plug-in connections.



Injection pulses of a switched output stage (measured at the injection valve)

a = Pulse length (dependent on engine load)

Continued on next picture page

Engine missing under all operating conditions (continued 13)

Injection valve mechanically
O.K.?

* Does engine speed drop when
injection-valve connectors
are pulled off?

N>

* With the engine running,
disconnect injection-valve
connectors individually, one
after the other, from the in-
jection valves and re-connect.
Engine speed must drop if
injection valve O.K.

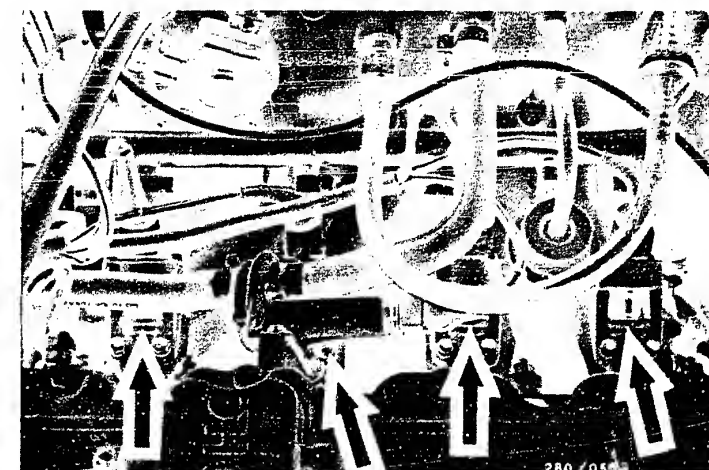
* If replacing, install only
injection valves 0 280 150 205.

Trouble-shooting program
completed for customer complaint

"Engine missing under all
operating conditions".

If the fault has not been found or
if further information is required
on how to remedy the fault, continue
with the trouble-shooting chart of
your choice.

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.



Arrows = Injection valves

Trouble-shooting program according to customer complaints

Procedure

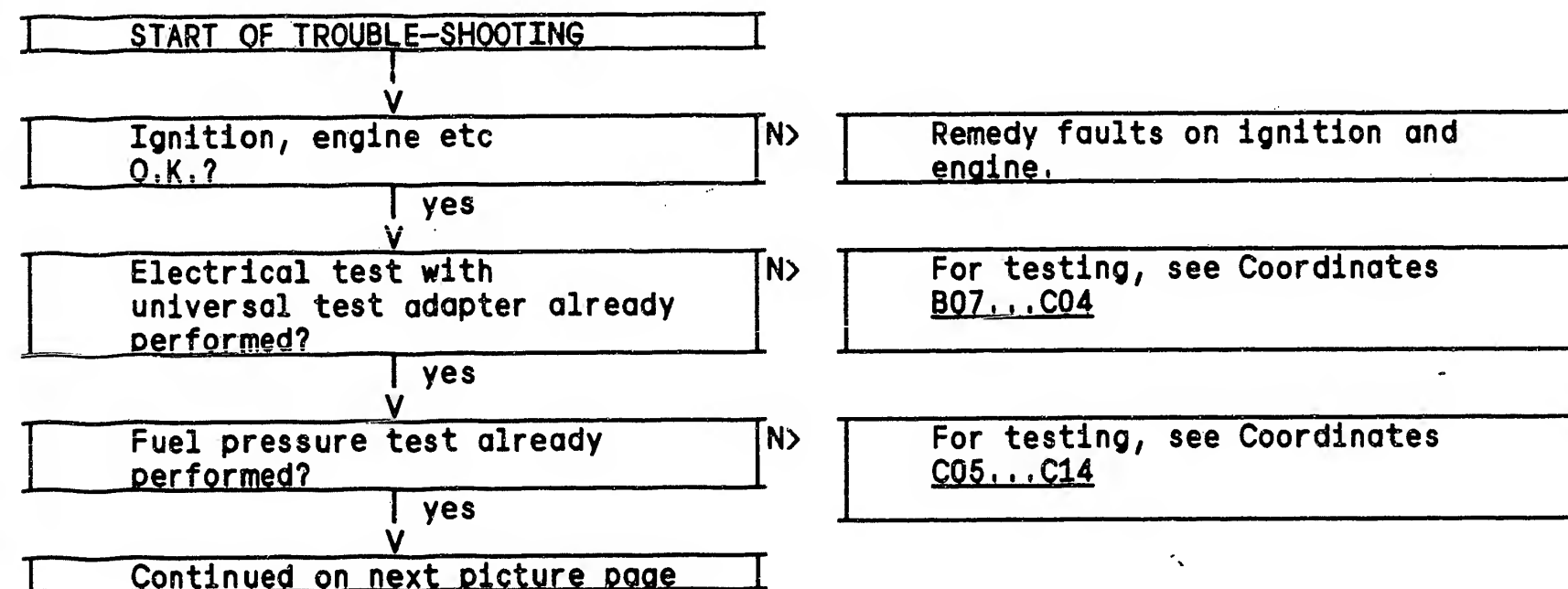
The test is divided into 3 rows of boxes:

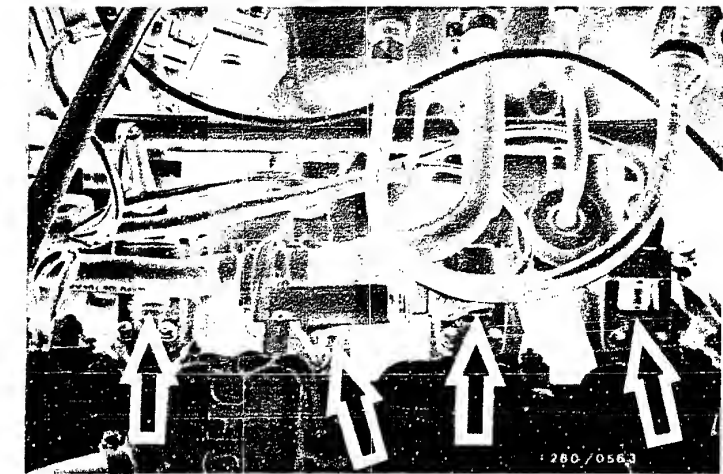
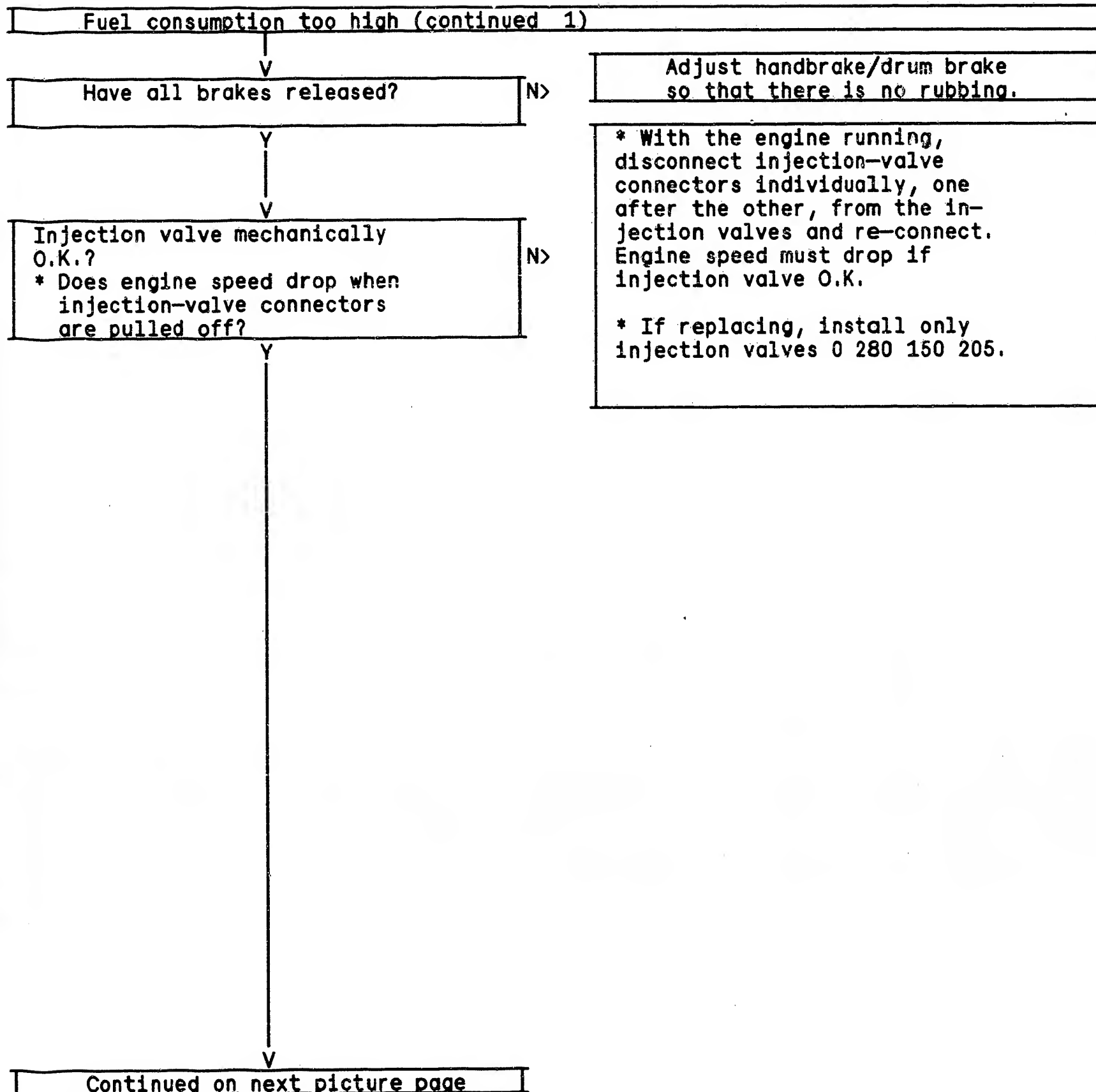
- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.





Arrows = Injection valves

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

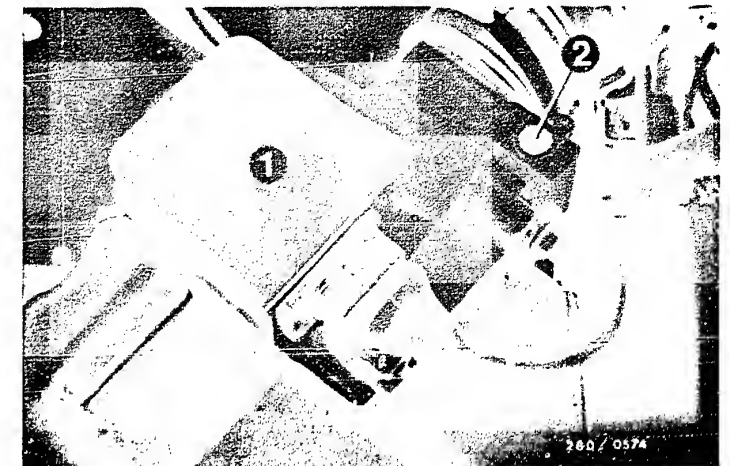
N>

Testing:

- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

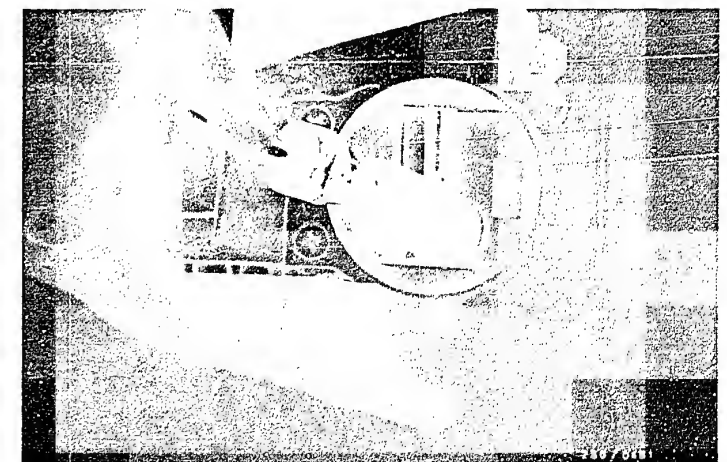
CAUTION !

After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Continued on next picture page

Fuel consumption too high (continued 3)

Idle speed and CO correctly adjusted?

N>

Idle speed not adjustable.

* Idle speed and CO adjustment
Exhaust-gas adjustment with exhaust-gas analyzer with engine at normal operating temperature and at idle speed.

* Idle speed

Manual transmission:

Europe: 850...900 min⁻¹

Sweden/

Switzerland: 900...950 min⁻¹

5-speed

(Europe): 900...950 min⁻¹

Automatic: 800...850 min⁻¹

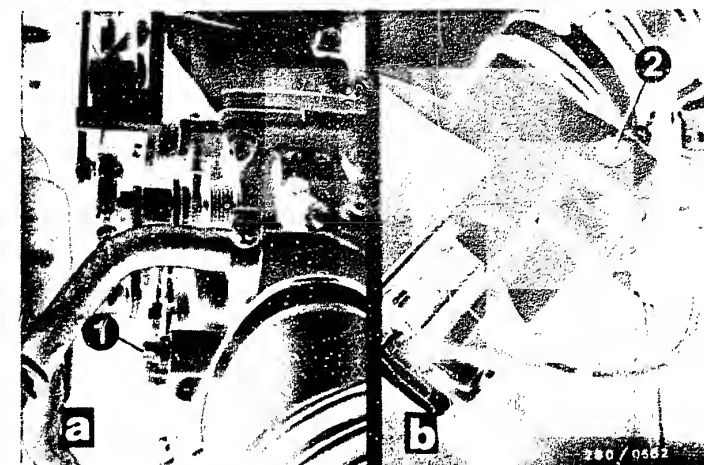
* CO concentration

Europe: 0,5...1,5 vol% CO

Sweden/

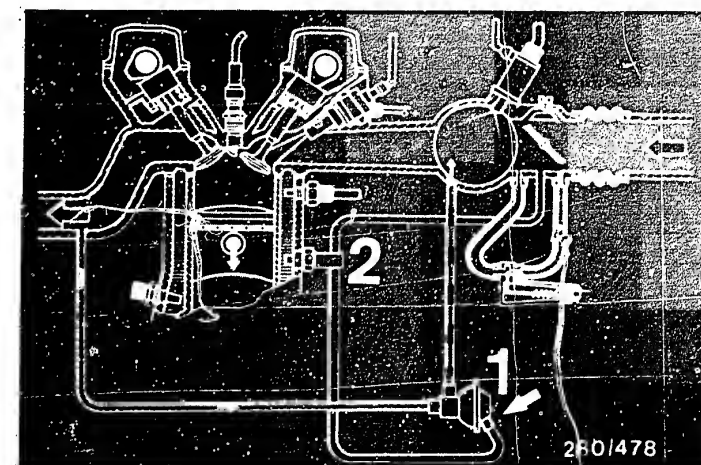
Switzerland: max. 0,3 vol% CO

* Due to certain exhaust emission legislation the vehicles of the Sweden/Switzerland version are equipped with exhaust-gas recirculation (EGR). When checking/adjusting the idle and CO, disconnect and seal the vacuum control line (arrow) on the EGR valve in order to guarantee that the EGR system is inoperative. It is not necessary to shut down the EGR system when running the vehicle in countries where such stringent regulations do not apply.



1 = Idle-speed
adjusting screw
2 = CO adjusting screw

1 = EGR valve
2 = Thermo-valve



Continued on next picture page

Continued on next picture page

For all vehicles:

If CO concentration too high,
turn bypass screw (CO
adjusting screw) in air-flow
sensor half a turn in a counter-
clockwise direction (hexagon-
socket-head cap screw
AF = 5 mm).
Check idle speed and CO con-
centration again.
If necessary, make corrections
in several steps. After
adjusting, use new (red) plugs
(1 280 508 012).

Trouble-shooting program
completed for customer complaint

"Fuel consumption too
high"

If the fault has not been found
or if further information is
required on how to remedy the
fault, continue with the trouble-
shooting chart of your choice

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.

MAXIMUM ENGINE POWER, TOP SPEED NOT REACHED

Trouble-shooting program according to customer complaints

Procedure

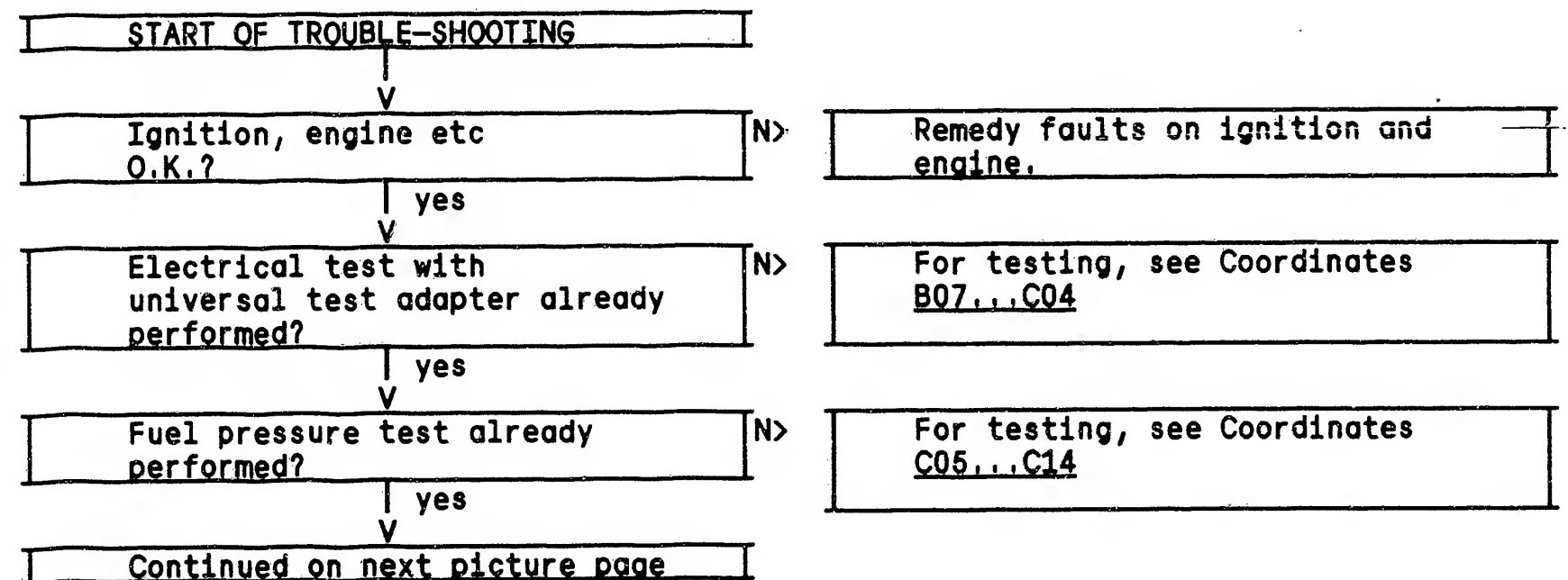
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Maximum engine power/top speed not reached
(continued 1)

V

Both throttle valves opening
fully?

* Accelerator, throttle linkage,
throttle cable O.K.?

N>

* Throttle linkage may stick
due to floor mat.
* If throttle cable kinked -
replace.

V

Continued on next picture page

Maximum engine power/top speed not reached
(continued 2)

V

Throttle-valve switch O.K.?

- * Does length of injection pulses at idle change when term. 3 and term. 18 are jumped (full-load enrichment in control unit)?

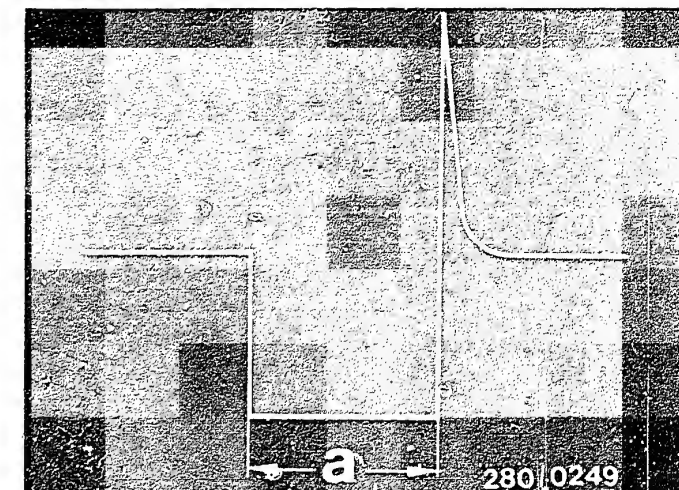
N>

Y

Connect test lead:

Connect 2-pole connection between an injection valve and its connecting lead. Of the other two terminals, only one terminal need be connected to a motor-tester (special input). The other terminal must not come into contact with ground.

- * If correctly connected, with the engine running, injection pulses are as in top diagram.
- * Check full-load enrichment. Watch injection pulses at idle. Disconnect throttle-valve switch plug and jump term. 3 and term. 18 (lead 9) (Insulated wire jumper). Do not bend plug-in tabs. Injection pulse must become longer.
If not: check connecting leads from control-unit plug to throttle-valve switch term. 3 and term. 18 (lead 9) for continuity. If O.K., replace control unit.



Injection pulses of a switched output stage (measured at the injection valve)
a = Pulse length (dependent on engine load)

Continued on next picture page

Maximum engine power/top speed not reached
(continued 3)

Delivery of electric fuel
pump O.K.?
Test specification: min.
700 cm³ /30 s

N>

* Measuring the fuel delivery:
For testing, undo junction
between fuel return hose
(from pressure regulator) and
fuel return line (to fuel
tank). If necessary, extend
hose and lead into a 5l
vessel with graduated scale.
Disconnect control relay.
Connect jumper into connection
base between term. 87b and
term. 30. Electric fuel pump
must operate.

Test specification:
min. 700 cm³ /30s

Caution: After testing is
completed, be sure to
remove the jumper.

Remedy if test specification
not obtained:

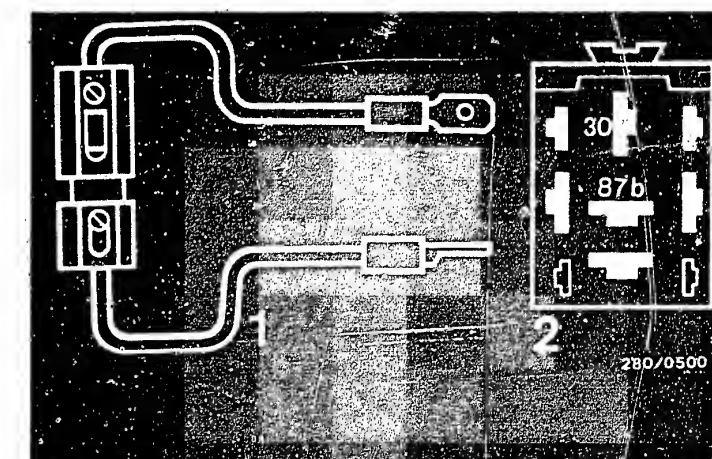
- * Fuel filter clogged - replace.
- * Voltage at the terminals
of the electric fuel pump with
engine running: min. 12 V. If
not, clean contacts; possibly
eliminate poor ground connection;
replace leads.

- * Fuel pressure regulator
defective - replace.
- * If delivery too low, replace
electric fuel pump.



- 1 = Intake manifold connection
- 2 = Pressure regulator
- 3 = Fuel-distribution pipe
(fuel delivery line)
- 4 = Fuel return line

- 1 = Jumper with fuse
holder and 10 A fuse
- 2 = Top view of connection
base



Continued on next picture page

Maximum engine power/top speed not reached
(continued 4)

V

Air-flow sensor mechanically
and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

N>

Between term. 8 and term. 9:
160...300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

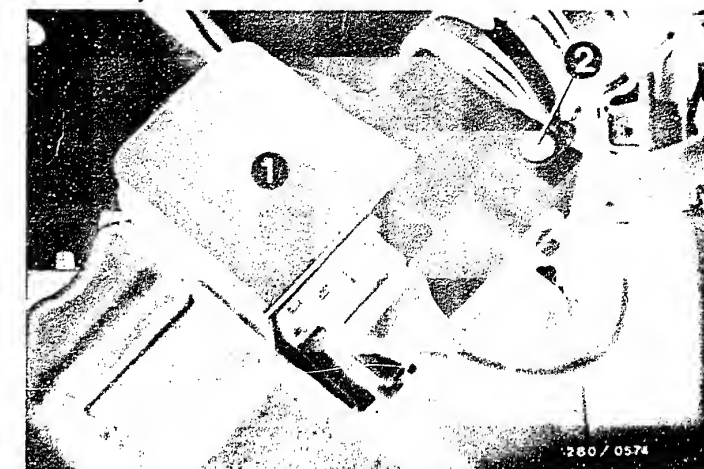
Y

Testing:

- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

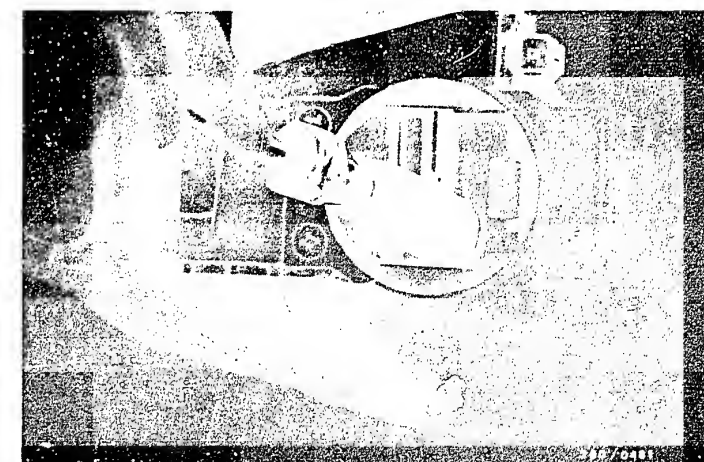
C A U T I O N

After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Continued on next picture page

Maximum engine power/top speed not reached
(continued 5)

V
Are all hose lines correctly
connected, not kinked or
damaged?

Visual examination.

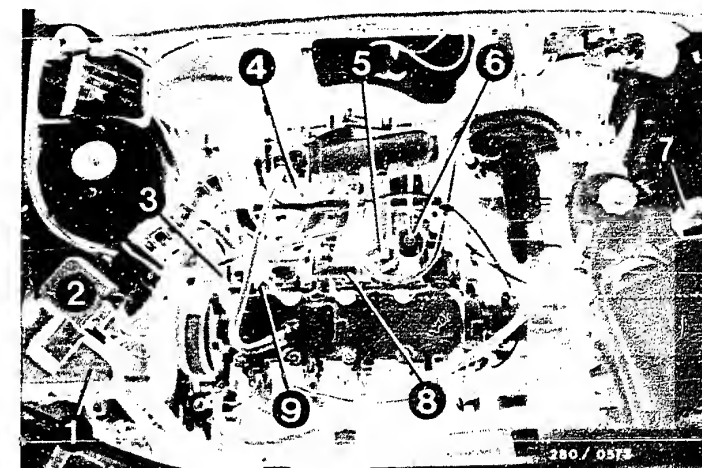
* Air-intake system checked for
leaks with 0.3 bar gauge
pressure?

N>

* Check whether hoses of
air-intake system and fuel line
system are correctly connected,
not kinked or damaged. Replace
hoses if necessary.
Eliminate leaks by new seals
or by retightening the connect-
ing screws.

* Leak test:

Seal off exhaust tail pipe.
Unscrew air-flow sensor from
air filter housing and seal
off air-flow sensor duct.
Disconnect hose after auxiliary-
air device and blow air (0.3 bar
gauge pressure) into the intake
manifold with a compressed-
air gun.
Seal off connection port on
auxiliary-air device.
Open throttle valve fully while
doing this.
Brush or spray all joints with
soapy water.
Leaks may also occur at the
following points on the engine:
Oil dipstick not securely
inserted, defective cap seal on
oil filler neck etc.
Bubbling or foaming indicates a
leak.



- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Temperature sensor II
- 4 = Throttle-valve switch
- 5 = Injection valves
- 6 = Pressure regulator
- 7 = Control relay
- 8 = Auxiliary-air device
- 9 = Central ground

V
Continued on next picture page

Maximum engine power/top speed not reached
(continued 6)



Trouble-shooting program
completed for customer complaint

"Maximum engine power/top
speed not reached"

If the fault has not been found
or if further information is
required on how to remedy the fault,
continue with the trouble-shooting
chart of your choice.

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.

Trouble-shooting program according to customer complaintsProcedure

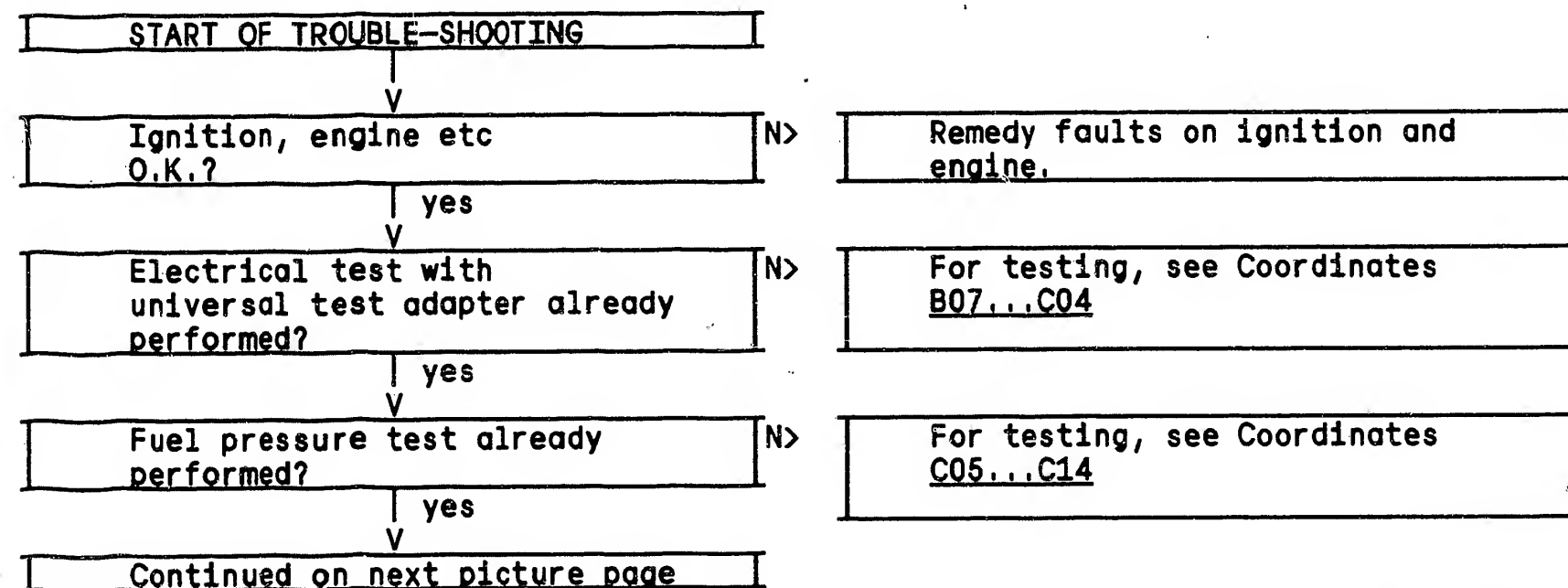
The test is divided into 3 rows of boxes:

- * The left-hand row contains the questions for the tests.
- * The center row describes the testing and adjusting operations on the components.
- * The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.

If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.

After testing, continue trouble-shooting at the point at which you branched off.



Idle speed and CO concentration too low or too high (continued 1)

Idle speed and CO correctly
adjusted?

N>

* Idle speed and CO adjustment
Exhaust-gas adjustment with
exhaust-gas analyzer with
engine at normal operating
temperature and at idle speed.

* Idle speed

Manual transmission:

Europe: 850...900 min ⁻¹

Sweden/

Switzerland: 900...950 min ⁻¹

5-speed

(Europe): 900...950 min ⁻¹

Automatic: 800...850 min ⁻¹

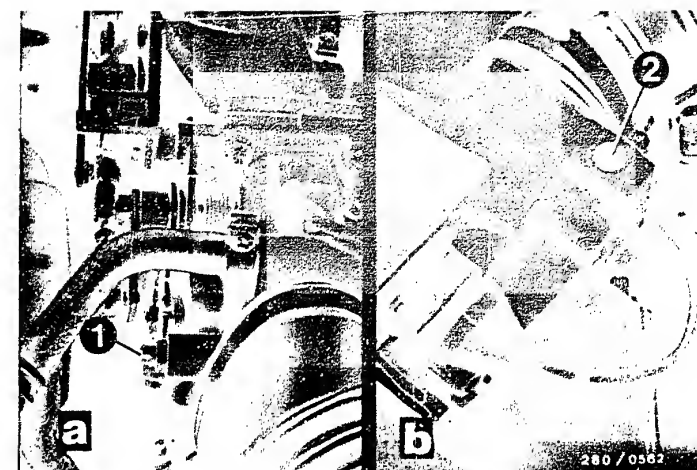
* CO concentration

Europe: 0,5...1,5 vol% CO

Sweden/

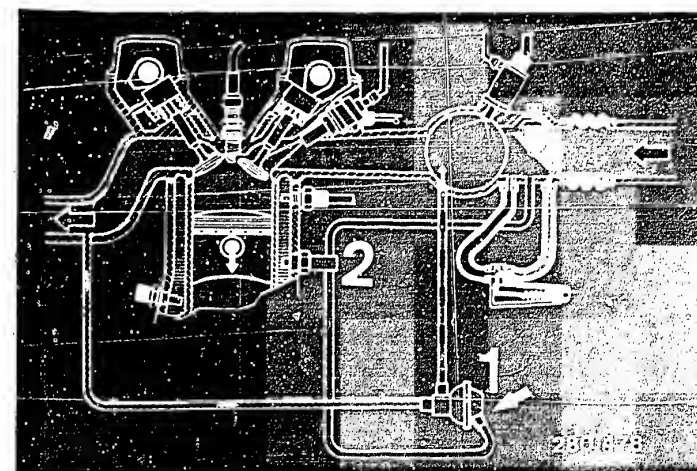
Switzerland: max. 0,3 vol% CO

* Due to certain exhaust
emission legislation the
vehicles of the Sweden/
Switzerland version are equip-
ped with exhaust-gas re-
circulation (EGR). When
checking/adjusting the idle
and CO, disconnect and seal the
vacuum control line (arrow)
on the EGR valve in order
to guarantee that the EGR
system is inoperative. It is
not necessary to shut down the
EGR system when running the
vehicle in countries where such
stringent regulations do not
apply.



1 = Idle-speed
adjusting screw
2 = CO adjusting scw

1 = EGR valve
2 = Thermo-valve

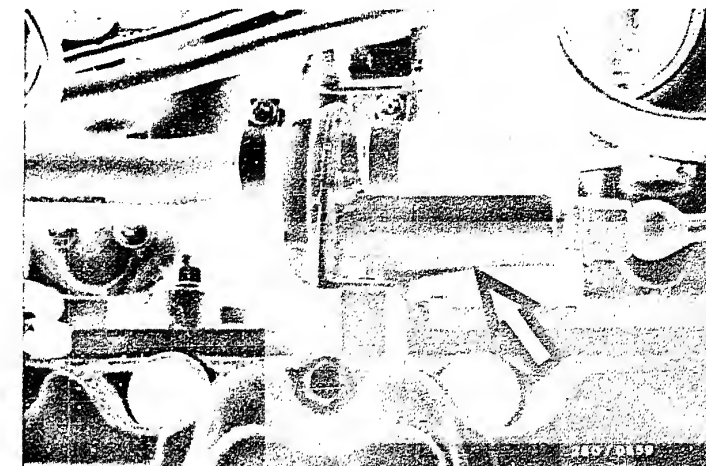


Continued on next picture page

Continued on next picture page

For all vehicles:

If CO concentration too high, turn CO adjusting screw in air-flow sensor half a turn in a counterclockwise direction (hexagon-socket-head cap screw AF = 5 mm). Check idle speed and CO concentration again. If necessary, make corrections in several steps. After adjusting, use new red plug. (1 280 508 012)



Arrow = Auxiliary-air device

Is idle speed adjustable?

Auxiliary-air device mechanically O.K.?

- * cold - open?
- * warm - closed?
- * Drop in engine speed when hose pinched off? (Engine cold)

N>

Check auxiliary-air device

* Visual examination

Disconnect hoses and look down, possibly using a small mirror. When cold, the cross section must be partially open; with the engine warm, it must be closed. If not, replace auxiliary-air device.

* Functional test

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With the engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If incorrect, replace auxiliary-air device (paying attention to direction of flow).

Continued on next picture page

Idle speed and CO concentration too low or too high (continued 3)

V

Electrical operation of
auxiliary-air device (power
supply, ground lead, resistance)
O.K.?

N>

Y

Start engine.

- * Voltage at plug min. 12 V.
If not, check the following
leads for continuity
(specification approx 0 Ω)
- * From term. 26 to central
ground.
- * Front term. 9/2 to control-unit
plug term. 9.
- * Resistance of auxiliary-air
device 30 ... 65 Ω (plug
disconnected). If resistance
not within tolerance, replace
auxiliary-air device.

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

- * Sensor flap moving freely?
- * Does sensor flap return to rest position?
- * Resistances within tolerance?

Between term. 8 and term. 9:
160...300 Ω

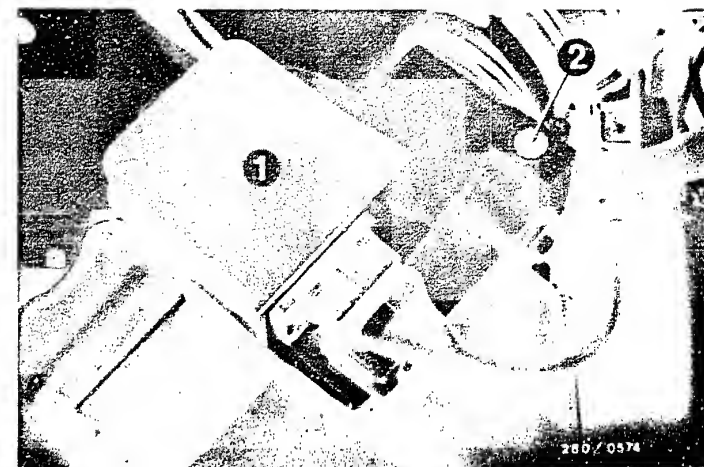
Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

N>

Testing:

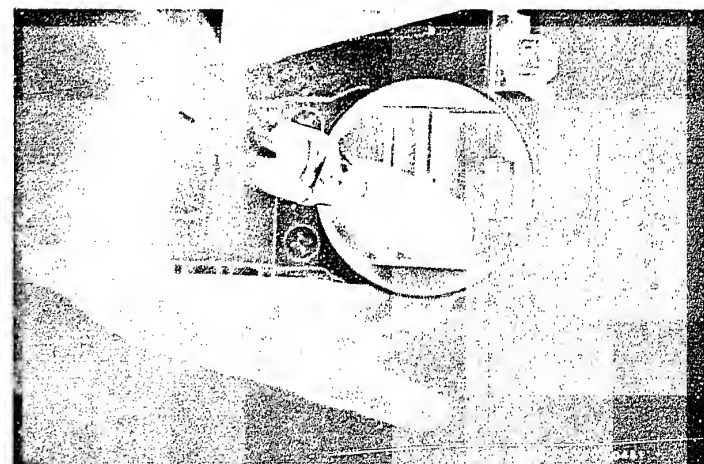
- * Unscrew air-flow sensor from air filter housing. Open sensor flap by hand. It must be possible to move sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close again fully by itself. Sensor flap must not catch when opening. Watch for signs of abrasion and rubbing. Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth. If there are signs of abrasion and rubbing, replace the air-flow sensor.
- * Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. The air-flow sensor must be replaced.
- * Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
Test specification: 160...300 Ω
Connect ohmmeter to term. 7 and term. 5 of air-flow sensor.
Deflect sensor flap.
Test specification: 60...1000 Ω

CAUTION
After testing is completed, air-flow sensor must be screwed back onto the air filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Continued on next picture page

V

CO reading greater than test specification?

Europe: 0.5 vol% CO
Sweden/Switzerland: 0.2 Vol% CO

Air-intake system checked for leaks?

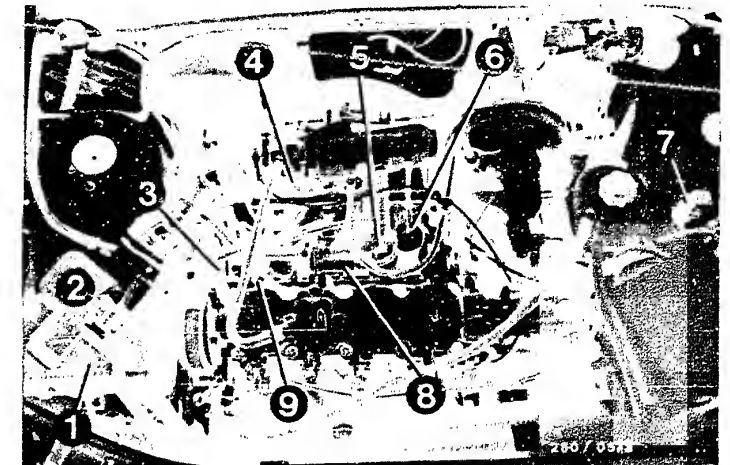
* Hose lines correctly connected, not kinked or damaged?

N>

* Check whether hoses of air-intake system and fuel line system are correctly connected, not kinked or damaged. Replace hoses if necessary. Eliminate leaks by new seals or by retightening the connecting screws.

* Leak test:

Seal off exhaust tail pipe. Unscrew air-flow sensor from air filter housing and seal off air-flow sensor duct. Disconnect hose after auxiliary-air device and blow air (0.3 bar gauge pressure) into the intake manifold with a compressed-air gun. Seal off connection port on auxiliary-air device. Open throttle valve fully while doing this. Brush or spray all joints with soapy water. Leaks may also occur at the following points on the engine: Oil dipstick not securely inserted, defective cap seal on oil filler neck etc. Bubbling or foaming indicates a leak.



- 1 = Air filter
- 2 = Air-flow sensor
- 3 = Temperature sensor II
- 4 = Throttle-valve switch
- 5 = Injection valves
- 6 = Pressure regulator
- 7 = Control relay
- 8 = Auxiliary-air device
- 9 = Central ground

V

Continued on next picture page



Trouble-shooting program
completed for customer complaint

"Idle speed and CO concen-
tration too low or too high"

If the fault has not been found
or if further information is
required on how to remedy the fault,
continue with the trouble-shooting
chart of your choice.

Detailed trouble-shooting chart
Coordinates B3...B4.
Direct trouble-shooting chart
Coordinates B3...B8.

PLUG CONNECTORS FOR JETRONIC COMPONENTS

|28|
VDT-I-280/111 En
11.1984
(supersedes Ed. 11.1982)

Parts sets

Parts sets are available for the replacement of Jetronic plug connectors. The parts sets consist of:

- * Plug connector housing
- * Protective cap (rubber sleeve)
- * Contact springs

These parts are listed on microcard EE... 1).
see microcard EE00 under 280 ...

- * Plug, black, 2-pole,
Parts set 1 287 013 002 cable connector in
conjunction with socket, 2-pole.

- * Socket, black, 2-pole,
Parts set 1 287 013 001 for e.g.:

Temperature sensor	0 280 130 0..
Auxiliary-air device	0 280 140 ..
Thermo-time switch	0 280 130 2..
Start valve	0 280 170 ..
Warm-up regulator	0 438 140 ..

- * Socket, gray, 2-pole
Parts set 1 287 013 003 for:
Injection valve 0 280 150 ..

- * Socket, black, 3-pole,
Parts set 1 237 000 039 for:
Throttle-valve switch 0 280 120 ..

- * Socket, black, 5-pole,
Parts set 1 287 013 006 for:

Air-flow sensor	0 280 20. ..
(LE version)	

- * Socket, black, 6-pole,
Parts set 1 287 013 004 for:
Air-flow sensor 0 280 200 ..

- * Socket, black, 7-pole,
Parts set 1 287 013 005 for:

Air-flow sensor	0 280 20. ..
Air-flow sensor	0 280 211 ..

- * Wiring-harness plug connector, black,
25-pole,
Parts set 1 287 013 009 for:
Control unit 0 280 0..

- * Wiring harness plug connector, black,
35-pole,
Parts set 1 287 013 008 for:
Control unit 0 280 0..

The contact springs (minitimers) are also
available separately under
Part No. 1 284 477 026.

The plug connector housings are available
only in the stated colors.

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ENCODING OF LE/LH-JETRONIC SOLENOID-OPERATED INJECTION VALVES

VDT-I-280/109 En
5.1982

With the introduction of the LE/LH-Jetronic, the internal resistance of the solenoid-operated injection valves has also been changed.

Solenoid-operated injection valve

- * L-Jetronic: 2.5 Ω at + 20° C
- * LE/LH-Jetronic: 16.2 Ω at + 20° C

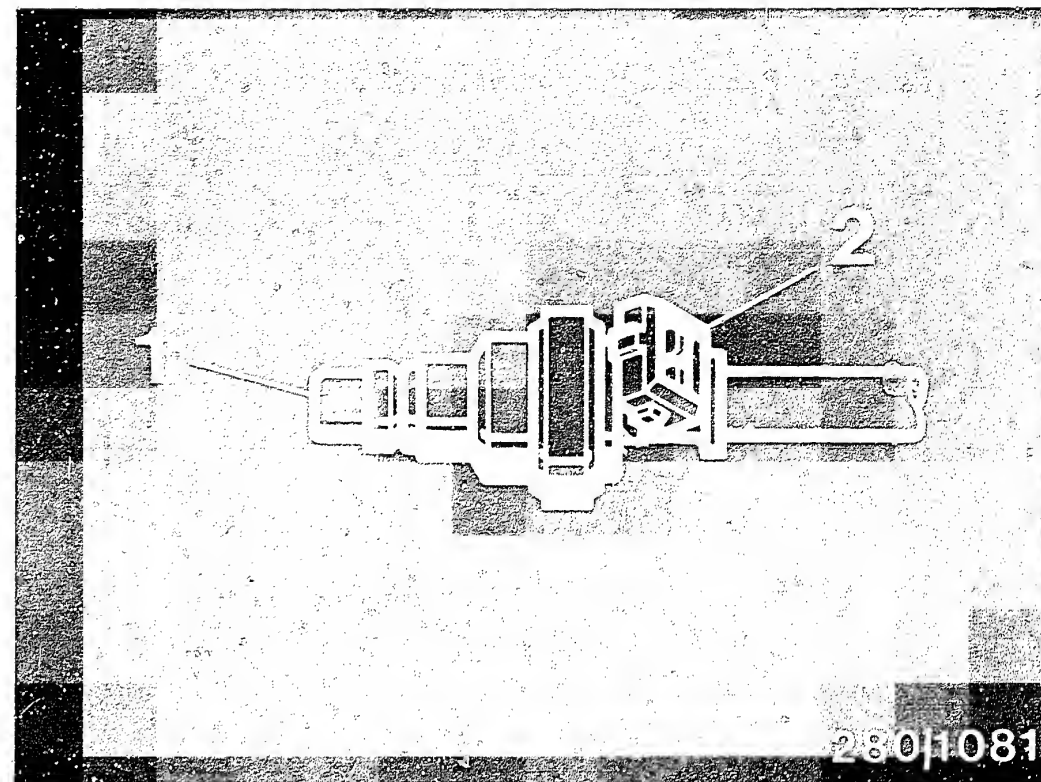
For cost and customer reasons, the plug contact has been left the same.

Caution:

If L-Jetronic solenoid-operated injection valves are installed in an LE/LH-Jetronic vehicle, either the control unit or the solenoid-operated injection valves will be destroyed.

Note:

- * Install only solenoid-operated injection valves having the correct part number for the vehicle in question.
- * As a guide, solenoid-operated injection valves with 16.2 Ω internal resistance have a yellow protective sleeve.



1 = Protective sleeve 2 = Plug connection

- * Color coding (yellow) of the plug connection (see also VDT-I-280/5) is not generally intended for LE/LH-Jetronic solenoid-operated injection valves.

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**EXPORT VEHICLES WITH
EMISSION CONTROL SYSTEMS**

VDT-I-Gen. 042 En
12.1981

Export vehicles for countries with stringent emission legislation have been equipped with various emission-control systems. To comply with the legal regulations, these systems are installed individually or in combination, depending on the model version.

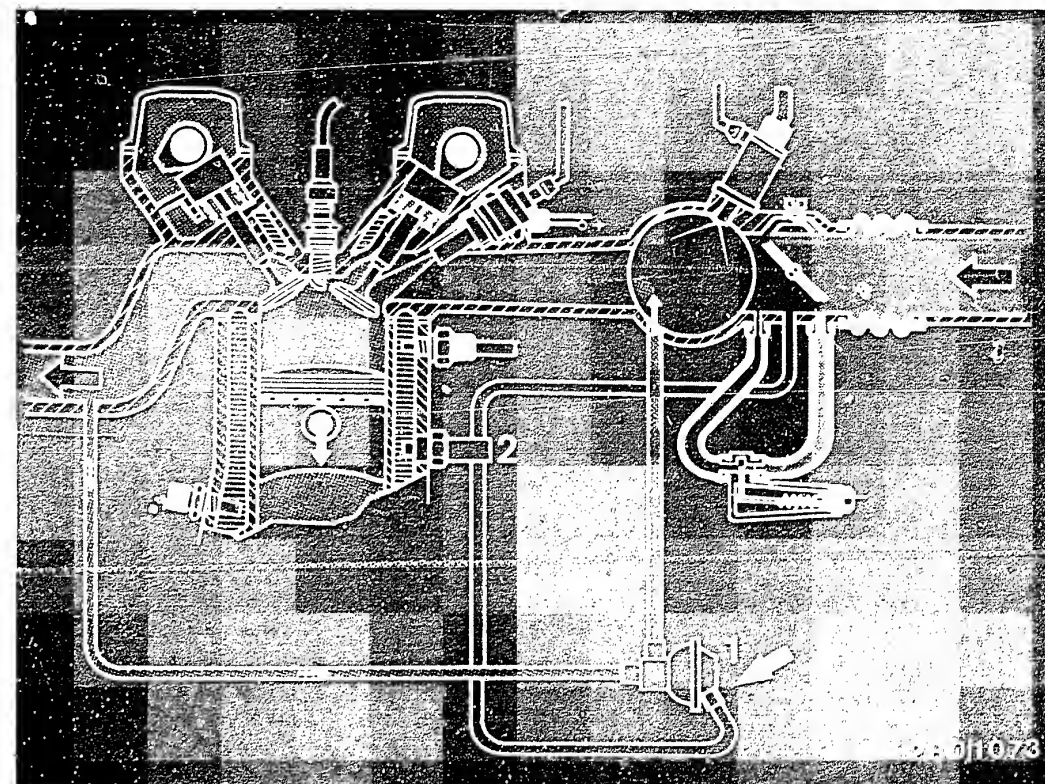
Emission-control system	predominantly used in export vehicles				
	Sweden	Australia	Canada	USA	Japan
EGR 1)	*	*	*	(*)	
Secondary-air induction 1)	*	*	*	(*)	(*)
Secondary-air injection 1)	*	*	*	(*)	(*)
Cat. converter 1)	—	—	—	*	*
Lambda control	—	—	—	*	*

The vehicle-related service manuals for the K- and L-Jetronic describe the construction and operation of the emission-control systems. Their influence must be borne in mind particularly when adjusting the idle and CO.

Export vehicles are found sporadically also in countries in which there is no requirement for particularly stringent emission control. This Service Information provides a general overview of various emission-control systems, as well as information for the after-sales service in countries with emission regulations which do not require such emission-control systems or unleaded fuel.

1) Non-Bosch products

(*) installed in some cases in older vehicles



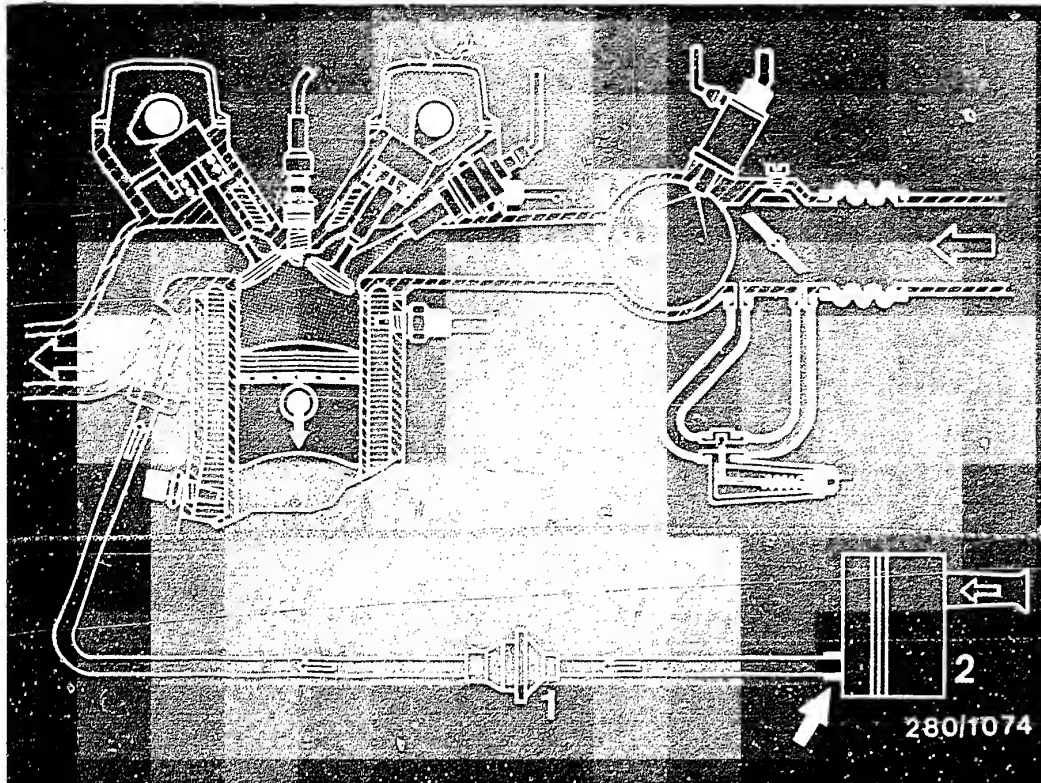
1 = EGR valve 2 = Thermo-valve

1. Exhaust-gas recirculation

(Exhaust Gas Recirculation = EGR)

Some of the exhaust gas is returned to the intake manifold through a vacuum-controlled EGR valve. This reduces the combustion temperature and the emission of nitrogen oxides (NOx). The thermo-valve and the arrangement of the vacuum tap on the throttle-valve assembly ensure that exhaust gas is recirculated only when the engine is warm, in the part-load range. There is an engine-speed reduction of approx 200 min⁻¹. At idle, full load and with the engine cold, there is no exhaust-gas recirculation.

When checking/adjusting the idle and CO, disconnect and seal the vacuum control line (arrow) on the EGR valve in order to ensure that the EGR system is rendered inoperative. If the vehicle is operated in countries not having such stringent emission legislation, it is not necessary to shut down the system.



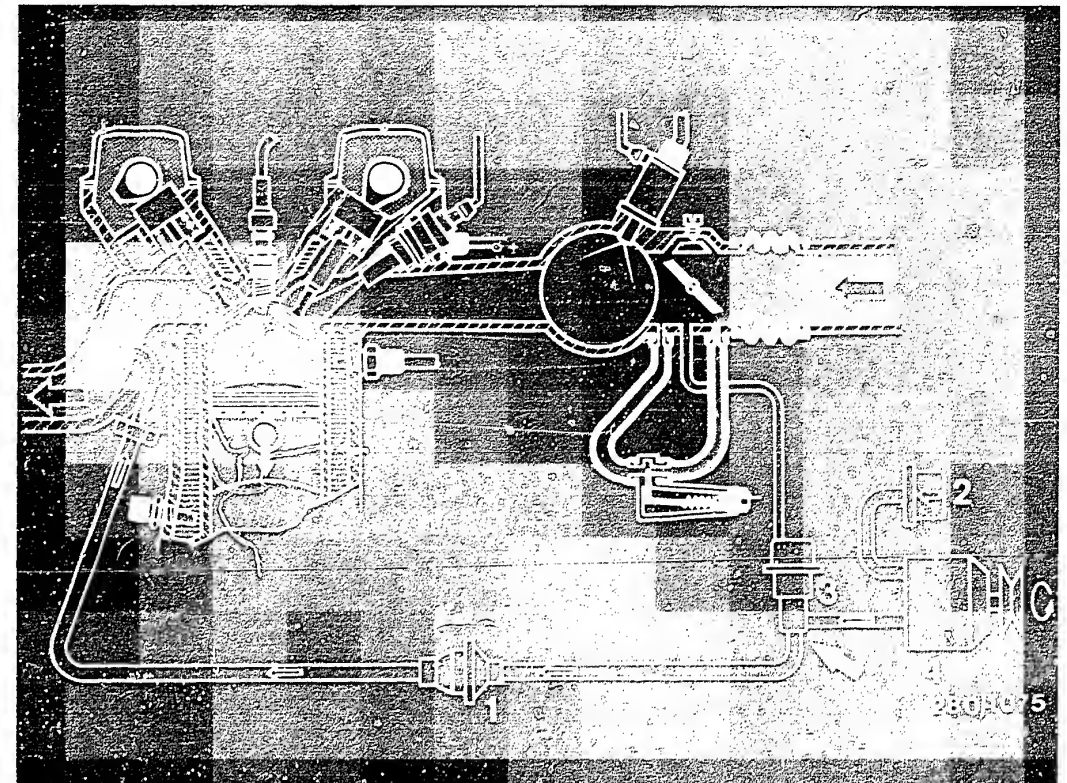
1 = Non-return valve 2 = Air filter

2. Secondary-air induction (e. g. Volvo Pulsair system)

Due to pressure and vacuum pulsation fresh air is induced by the exhaust gas into the exhaust ports through a non-return valve. Unburned carbon monoxide (CO) and hydrocarbon (HC) residues are partially after-burnt; the exhaust gas then contains fewer pollutants.

When checking/adjusting the idle and CO, the secondary-air induction system must be rendered inoperative. To do this, disconnect hose between non-return valve and air filter on air filter (arrow) and seal tight with a plug.

It is not necessary to shut down the secondary-air induction system if the vehicle is operated in countries not having such stringent emission legislation.



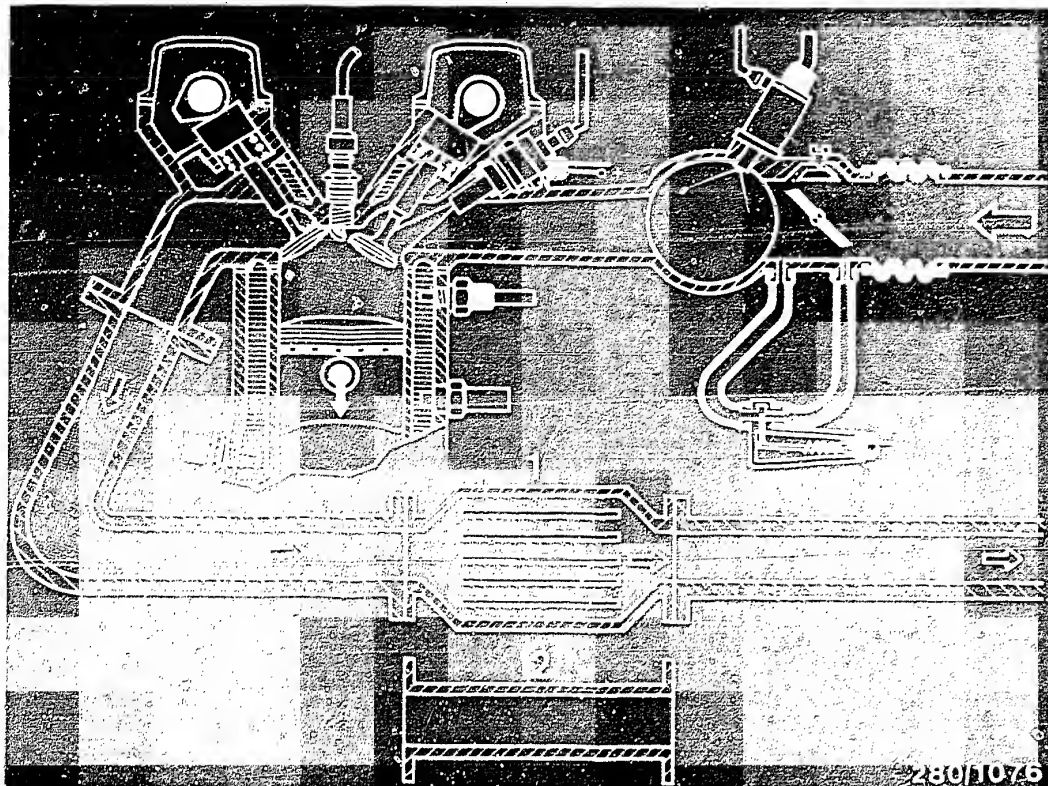
1 = Non-return valve 3 = Change-over valve
2 = Air filter 4 = Air pump

3. Secondary-air injection (Air Injection System)

An engine-driven air pump draws in fresh air through the air filter and forces it through a non-return valve into the exhaust ports. As with secondary-air induction, there is a partial afterburning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When checking/adjusting the idle and CO, it is necessary to switch off the air injection system. To do this, disconnect hose at outlet of change-over valve (arrow) and seal tight with a plug.

It is not necessary to shut down the secondary air injection system if the vehicle is operated in countries not having such stringent emission legislation.



1 = Catalytic converter 2 = Intermediate pipe

4. Catalytic converter

The single-bed catalytic converter installed in the exhaust system of export vehicles (also with lambda closed-loop control) reduces to a minimum all three pollutants CO, HC and NOx. The catalytic surface triggers off chemical reactions of the pollutants, as a result of which they lose their toxicity.

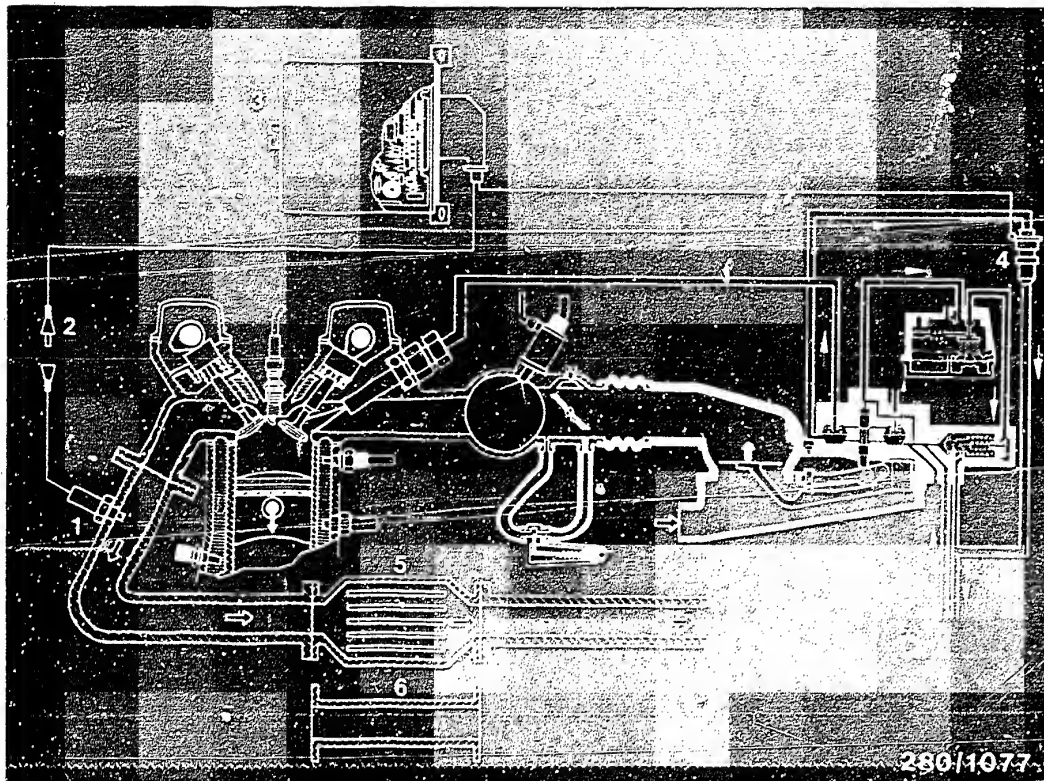
Important! This system can only operate in conjunction with unleaded fuel (currently only in the USA and Japan).

When checking/adjusting the idle and CO, the catalytic converter has no influence since the exhaust sampling point is before the catalytic converter.

Caution!

If the vehicle is operated with leaded fuel (predominantly in countries without stringent emission legislation), the catalytic converter must be removed. Clogging of the catalytic converter would otherwise lead to reduced power from the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.



- | | |
|-------------------|-----------------------|
| 1 = Lambda sensor | 4 = Timing valve |
| 2 = Plug | 5 = Cat. converter |
| 3 = Control unit | 6 = Intermediate pipe |

5. Lambda closed-loop control

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function to the K- and L-Jetronic is not a secondary emission-control system, but ensures low-pollution exhaust gas at the primary stage by means of optimum mixture preparation. In most cases, therefore, it is possible to dispense with additional exhaust-gas recirculation, secondary-air induction or injection. Like the catalytic converter, the lambda sensor (sensor in exhaust gas) also operates only with unleaded fuel.

If the vehicle is operated with leaded fuel, the lambda sensor becomes clogged and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control.

Due to a fixed control function, the system then operates like a K- or L-Jetronic, without lambda closed-loop control.

Before operating with leaded fuel, the lambda sensor should be removed, and the hole should be closed with a screw plug M 18 x 1.5 (thread length max. 8.5 mm).

The disconnected plug (2) of the sensor connecting lead should be insulated and fastened to a suitable point on the vehicle body.

Caution!

Under no circumstances may the control unit or the timing valve be shut down with the lambda closed-loop control of the K-Jetronic.

The catalytic converter should be replaced by an intermediate pipe.

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After-Sales Service Department for Training and Technology (KH/VSK)

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MOTOR VEHICLE SERVICE INFORMATION

UNIVERSAL TEST ADAPTER

VDT-I-Gen. 1001 Ee
1.1982

1. Application

The multitude of injection and ignition systems on the market as well as the further developments which are to be expected call for a new test concept. To keep the outlay on testing equipment and thus the costs within limits, the universal test adapter has been developed.

With a basic test adapter and exchangeable, system-matched adapter leads, it is possible to test the following systems:

1.1 Systems which have been installed as standard equipment:

- * L-Jetronic (1st generation)
- * LE-Jetronic (L-Jetronic 2nd generation)
- * Motronic (with new pin assignment, see vehicle-related instructions.)

1.2 Systems whose introduction is planned:

- * Motronic with transmission control
- * KE-Jetronic
- * Mono-Jetronic
- * Electric computerized ignition system (EZF)

2. Delivery dates and part numbers

Available as of 2.1982

2.1 Universal test adapter (basic unit)

Part No.: 0 684 101 801
Designation: ETT 018.01

2.2 System adapter lead for LE-Jetronic (L-Jetronic 2nd generation)

Part No.: 1 684 463 123
First application: for BMW 2.5/2.8 l
Engines as of 9.81
and Opel 2.0 l
engine (Manta/Rekord)
as of 9.81

2.3 System adapter lead for Motronic with new pin assignment

(see vehicle-related instructions)
Part No.: 1 684 463 124
First application: Porsche 944 as of
production, BMW as of
approx 3.82 (Europe)

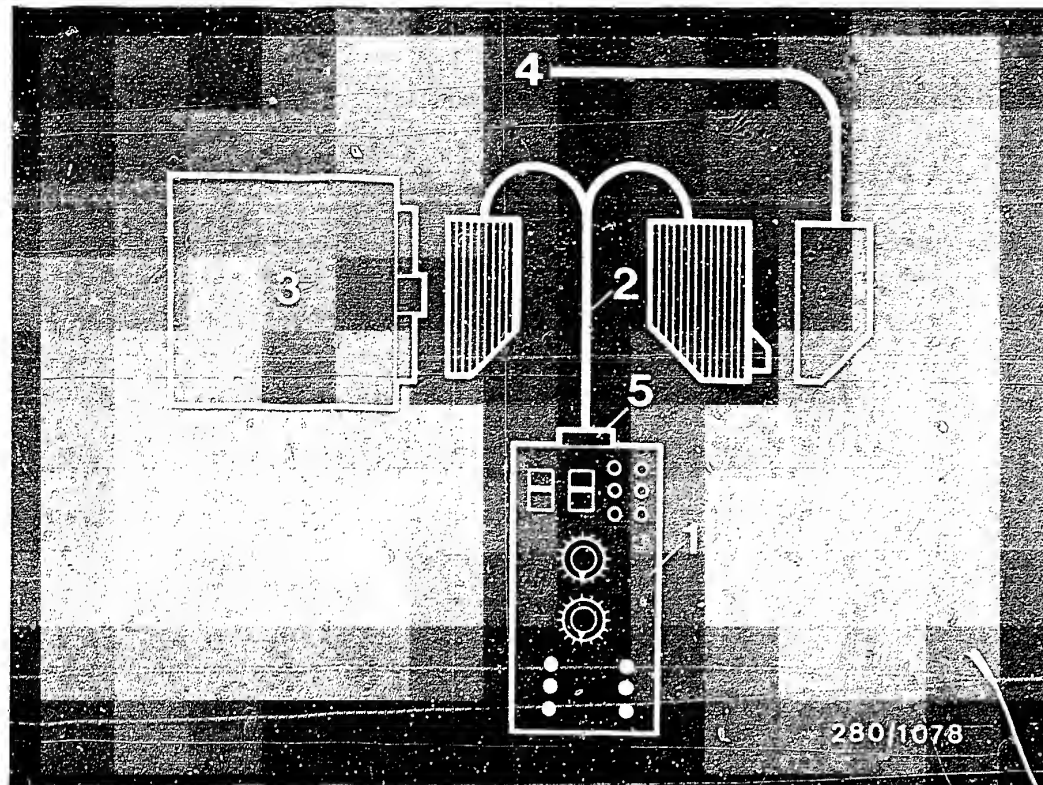
2.4 System adapter lead for L-Jetronic (in preparation)

Further system adapter leads will be made available on the introduction of the above-mentioned systems.

3. Test concept

The systems and components are checked for voltage and resistance values as well as for correct operation. Evaluation is by means of multimeter and motortester which are connected to the universal test adapter.

Depending on the complexity of the system, the exchangeable adapter lead is offered in version 1 or 2.

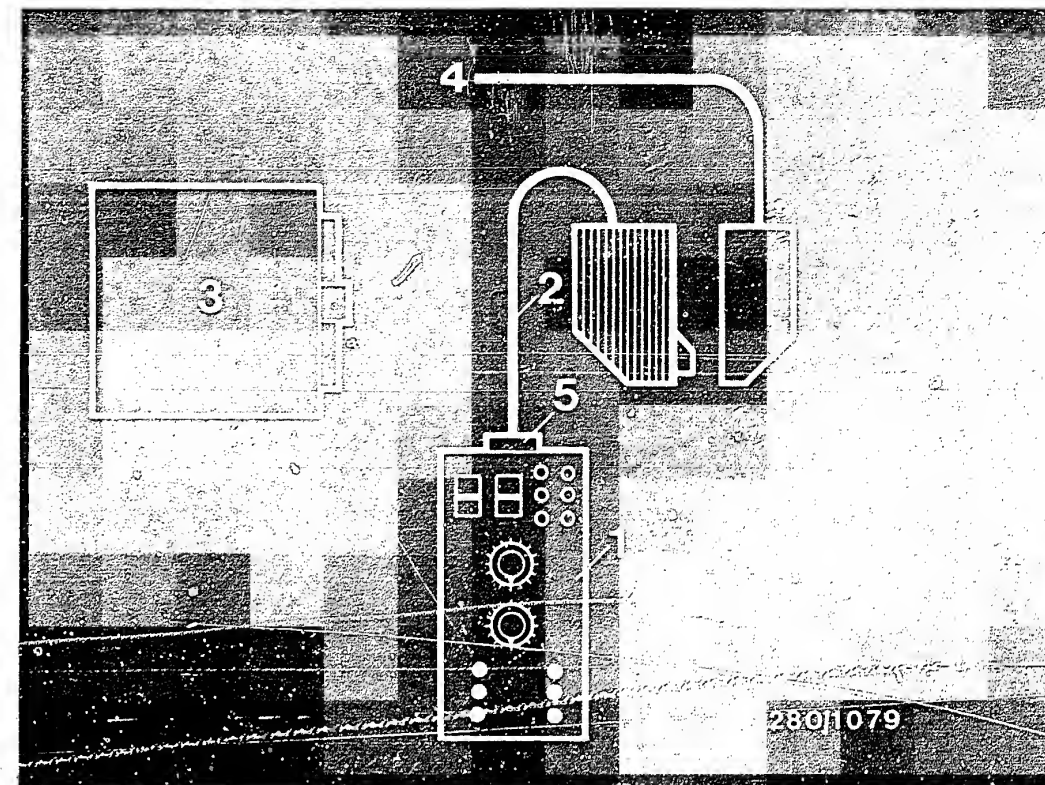


- 1 = Universal test adapter (basic unit)
- 2 = System adapter lead (Y version)
- 3 = Control unit
- 4 = System wiring harness
- 5 = Plug connector

3.1 Adapter lead for testing of peripherals and functional test (Version 1)

The universal test adapter with system adapter lead is to be connected to the system wiring harness and to the control unit (e.g. Motronic).

Scope of test: Wiring harness with components and control unit.



- 1 = Universal test adapter (basic unit)
- 2 = System adapter lead
- 3 = Control unit (not connected)
- 4 = System wiring harness
- 5 = Plug connector

3.2 Adapter lead for testing of peripherals (Version 2)

The universal test adapter with system adapter lead is to be connected only to the system wiring harness (e.g. LE-Jetronic (LE-Jetronic 2nd generation)).

Scope of test: Wiring harness with components
(without control unit)

4. Construction of universal test adapter

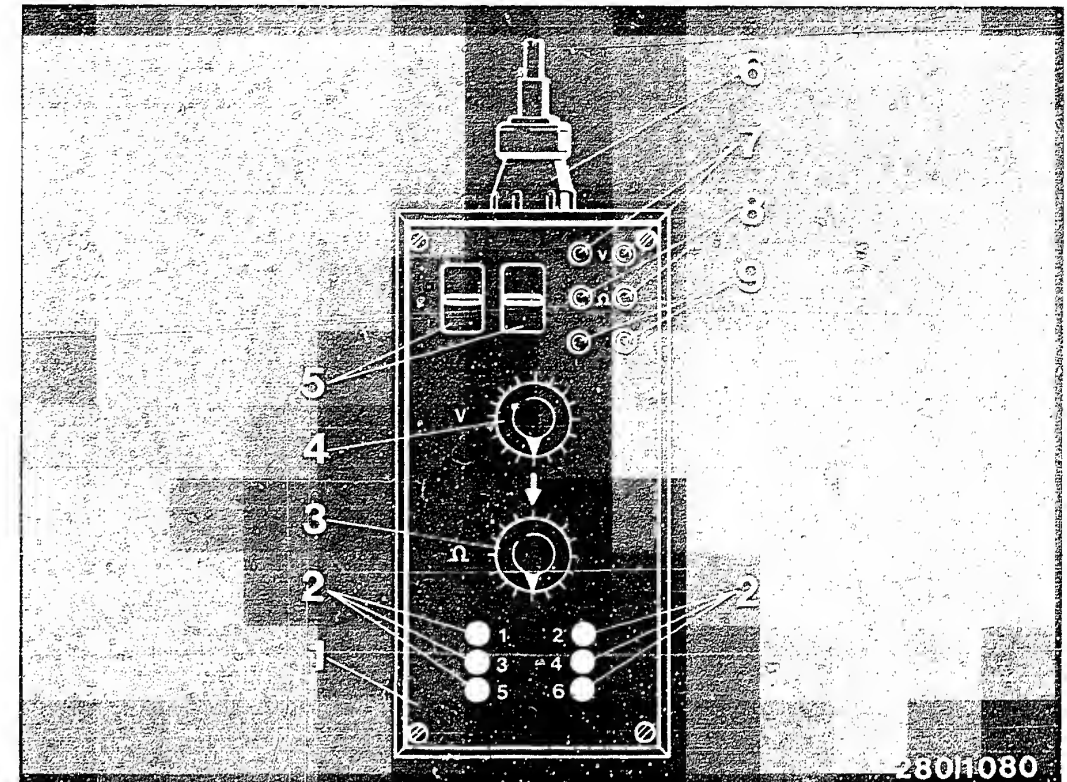
The universal test adapter contains 2 program switches for measuring voltages and resistances.

Readings are made on the multimeter which is connected to the universal test adapter.

For reasons of safety, the voltage and resistance sockets are separate.

To measure signals (e.g. injection pulses, ignition pulses), a motortester is to be connected to the test wells (special input).

For functional tests with the control unit connected, various engine operating conditions are simulated in some program steps by pressing certain buttons; the influence of these engine operating conditions is then evaluated with the motortester.



- 1 = Universal test adapter (basic unit)
- 2 = Button panel for simulation
e.g. engine temperature, throttle position etc
- 3 = "Ohm" program switch for resistance measurements
- 4 = "Volt" program switch for voltage measurements
- 5 = Test wells (for the special input of the motortester)
- 6 = 63-pin plug connector for connection of system adapter lead
- 7 = Test sockets (voltage measurement with multimeter or motortester)
- 8 = Test sockets (resistance measurement with multimeter)
- 9 = Sockets for special functions (not yet occupied)

Notes:

1. The Motronic test adapter (0 684 101 800 ETT 018.00) is still used for BMW Motronic vehicles (with old pin assignment) up to approx 3.82 date of manufacture (see vehicle-related instructions).
2. Operation of universal test adapter and test specifications are to be found in the vehicle-related service instructions:
3. Caution: Change of Part Number:
On SIS microcard OPE-00/J22 (Coordinates A14 und A17) the new part no. is

Universal test adapter	0 684 101 801
Adapter lead	1 684 463 123

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When direct trouble-shooting a specific LE- version, it is absolutely essential to look up the respective test step under the customer complaint.

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